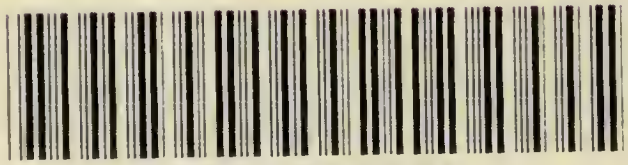
A GUIDE TO SICK NURSING IN THE TROPICS

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A GUIDE

TO

SICK NURSING IN THE TROPICS

ALSO BY THE AUTHOR

12s. 6d.

THE PREVENTION OF DISEASE IN TROPICAL AND SEMI-TROPICAL CAMPAIGNS

Founded on Parke's Memorial Prize Essay of 1886.

(J. & A. CHURCHILL.)

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A GUIDE

TO

SICK NURSING IN THE TROPICS

BY

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PREFACE.

These lectures, which originally appeared in The Nursing Mirror, are now published in book form, in the hope that they may be of some use to those engaged in the nursing of sick patients in the tropics. In the latter regions, if anywhere, the physician must acknowledge the invaluable assistance of the nurse, and especially will he feel this when, as so often happens, he is unable to obtain her assistance for some days.

In these lectures the author has laid stress on the causation of the several diseases; he has given a brief description of them, and has detailed the precautions to be taken both by the nurse as regards herself and as regards the conveyance of the disease to others. Finally, the actual details of the nursing of the different diseases are set forth.

It will be seen that not every tropical disease has been entered into. The class of affections due to certain of the animal parasites, for instance, have not been described, as there are no special details as regards nursing.

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ERRATA.

Page 47, line 10, *for* " Frayrer " *read* " Fayrer."
,, 54, ,, 25, *for* " Tropical " *read* " the art of."
,, 100, ,, 16, *for* " Inoculation " *read* " Incubation."

NURSING
IN
TROPICAL CLIMATES.

CHAPTER I.

THE NURSE—HER QUALIFICATIONS FOR THE TROPICS—HER PRECAUTIONS IN THE TROPICS.

The value of good nursing in disease is nowhere more apparent than in the tropics. My experience of the vast assistance on the one hand, and of the lack of help on the other, by the presence or absence of a reliable nurse has been gained by my service in India; but both these factors must be equally prominent in other parts of the tropical world. In India it often must happen that some days elapse before a nurse can be obtained for one's patient. During this time the amount of work and anxiety entailed on the physician in attending on the sick is not light, as he has in a bad case, in addition to his own duties, no rest at night. Hence, if anywhere, it is in the tropics that one has learnt to value the aid given him by the nurse.

I propose in these lectures to consider: —

A. The necessary qualifications of the nurse and the conditions necessary for preserving her health.

B. The clinical signs of the disease in question.

C. Her duties during the treatment of the several diseases.

D. Her duties as regards the preventive measures with reference to the diseases in question.

E. The precautions she should take as regards herself against disease.

THE NECESSARY QUALIFICATIONS OF THE NURSE.

(*a*) *Age.*—Owing to the time employed before the nurse is considered completely and fully educated in her profession, she attains to the age most suitable for embarking on her duties in tropical climates. Undoubtedly the period from 25 to 35 years of age constitutes the age during which she will best work in these regions. Before 25 she will be more liable to many of the diseases there prevalent; after 35 she will be too old to begin to work in the tropics. This fact is fully illustrated by the statistics obtained from the army in India. To take enteric fever, for instance. It is well known that this disease is most prevalent amongst soldiers of the age of 22 and under. Thus, taking the percentage of cases amongst the European troops in India during a certain year, we find the following:—

Age	Per 1,000 of strength
22 and under	33.17
22 to 24	18.68
24 to 26	13.11
26 to 28	6.73
28 to 30	2.58
Above 30	2.41

Colonel Welch, R.A.M.C., has shown that if men were excluded from India up to 25 years of age enteric fever would form but a very small proportion of the disease returns. During the Transvaal war, owing to the exigencies of the situation, there

were only a few drafts from England; the time-expired men were retained, and thus the average age of the soldier serving in India was increased. What was the result? There was a drop in the admissions for enteric for the ages of those with under one year's service from 91.5 per 1,000 in 1898 to 30.4 per 1,000 in 1900. Again, the same thing is shown in the case of a second tropical disease, to wit, dysentery. Dr. Bryden here has shown that the admissions in the third year of service in India were one-half those of the first year. Lastly, it may be mentioned that the late Deputy-Surgeon Hewlett, C.I.E., recommended that soldiers should not be allowed to land in India until they had attained the age of twenty-five. It thus is seen that the nurse enters on her duties in the tropics at the right age.

(*b*) *Medical Examination.*—Nurses proceeding to the tropics are, or should be, medically examined. They, it is needless to state, must be thoroughly sound in all respects. There must, for instance, be no albuminuria, no asthma, no cardiac affections. With regard to a tendency towards phthisis, a few words may be said. It may happen that after qualifying in her education a nurse may show signs of a weak chest, and at the same time be desirous of continuing her vocation. Does a weak chest contra-indicate a tropical life? According to my experience it does not; on the contrary, such a condition is benefited thereby. A friend of my own in 1880 showed evident signs of phthisis, and circumstances prevented his return to England. When I left India in 1900 his health was greatly benefited; although he had been exposed during his work to much labour, yet he had wonderfully improved. If he had been enabled to return to England it is doubtful if he would have been alive. My opinion on this question is shortly this. People with what is popularly termed a "weak chest" are not thereby debarred from serving in India, but they,

as far as my experience teaches me, do much better there than in cold climates. Of course a nurse with actual disease should be rejected when in an incipient stage, not so much on account of herself, as on account of the patients she may have to attend upon. Hæmorrhoids should debar a person from going to India, as the affection will certainly increase there. Any liability to congestion of the liver should not be present.

(*c*) *Temperaments.*—The late Surgeon-General Sir William Moore, in his apposite remarks concerning temperament in its relation to the tropics, held that individuals characterised by a nervous temperament, marked by much energy, and a large amount of mental power, but existing in a frame, the chest of which is narrow, with languid circulation, pallid skin, and spare muscles, with movements now hasty, now languid, are not fitted for the tropics. They are prone to nervous maladies and congestion of the various internal organs. Their sensitive nature is ill-fitted to withstand the daily irritations that are the lot of those living in the tropics from the heat, the flies, the mosquitoes, the discordant notes of the "brain fever birds," the domestic worries of the servants, etc. The temperaments best fitted for the East are the so-called Bilious, or Bilio-sanguine, inasmuch as these are associated with the greatest endurance and the least sensibility to external impression. Next to these as regards suitability comes the sanguine temperament, inasmuch as there is a less liability to anæmia.

THE REGULATION OF ONE'S LIFE IN THE TROPICS.

(*a*) *Dress.*—One of the mistakes that individuals setting out for the tropics commonly make is to take out a large outfit. In India everything can be obtained suitable for dress, and much cheaper than at

home. One good suit should be taken for special occasions, and to serve as a pattern. Cotton drill, serge, etc., can all be obtained in the Presidency towns, or at the Elgin and Muir Mills, Cawnpore, or at the Basel Mission, Cannanore, whilst the native tailor, or dherzi, can copy anything—in fact, he does so too faithfully sometimes, as witnessed in the well-known story where the dherzi copied the patch of the suit that was given him. Linen or cotton should never be worn next the skin. These materials become soaked with perspiration, and need changing oft-times in the day. Now woollen material has great absorptive power of moisture, and is a great preservative against getting chilled: its power of permeability to air, so necessary for the healthy exchange of gases and a healthy atmosphere immediately round the body, is nearly double that of cotton. Again, the coolest things to wear in the hottest days in India are flannels. If you place two thermometers respectively under a blanket and a sheet during the day when the temperature, say, is 90°, the thermometer under the cotton will show much the higher range. An ample supply of boots and gloves should be taken, the former being kept off the ground or in a tin-lined box, and the latter wrapped up separately in tissue paper and kept in a large corked bottle or air-tight case to prevent them becoming mildewed. Cholera belts should always be worn: these can be best made out of a strip of flannel. Two pairs of neutral tinted glasses should be taken.

(*b*) *Food.*—Everyone knows that the greatest care must be taken as regards stimulants. Tonic water is an excellent beverage, whilst the efficacy of tea and coffee in the tropics is manifest when we consider that the sun's action diminishes the action of the skin, lessens nervous activity, causes less carbonic dioxide to be exhaled, and induces cardiac paralysis. Now the above beverages have exactly

the opposite effects. If stimulants be taken, the best form is whisky. Every nurse should possess a filter, and the investigation into the relative efficacy of filters some few years back showed that only the Berkefeld and Pasteur filters were of real use. Of these the Pasteur will not permit the passage of the enteric bacillus, whereas the latter can pass through the candle of the Berkefeld in from four to eleven days, so that the latter should be, if used, sterilised every three days.

How to clean a Berkefeld Filter.—It is well to know how to clean one of these instruments. The result of boiling a filter charged with bacteria is that the albuminous matter composing them become coagulated in the pores, and hence the filter is less porous, and after many boilings it may become impervious to water. There are various ways of cleaning the instrument.

(i) The best way is to dry it carefully in a water oven, and then burn the organic matter away in a muffle. This, however, cannot be done in an ordinary house naturally.

(ii) Another method is to have two sets of bougies, one being used whilst the other is being cleaned. The latter is disconnected from the apparatus, all the metal parts removed, and the bougie immersed in 5 per cent. hydrochloric acid for a day or two: next it is boiled, but this is unnecessary if the first gallon of water filtered through the bougies after removal from the hydrochloric acid be thrown away. In this method the bacteria in the bougie are killed, and the albumin converted into acid albumin, which does not coagulate in the spores on boiling.

(iii) Where only one bougie is in one's possession a very simple method is the following, according to the Berkefeld Filter Co.—namely, to place the bougie, under a tap, and gently brush it with a piece of loofah, or a soft brush. No soap or other greasy material should come into contact with the bougie.

Lastly, in the process of purification of the drinking water, where you both filter and boil, always remember to filter first and then boil, *not* boil first and then filter.

With respect to solid food, Surgeon-General Maclean, a former Professor of Military Medicine at Netley, always enjoined that temperance was of great importance both as regards solids and liquids. He laid down that as a rule only one meal a day should contain meat.

(*c*) *Exercise.*—It is essential that every nurse should take some form of exercise during the 24 hours, thus preventing congestion of the various internal organs, especially the liver, that follow a sedentary life. Where compatible with her duties, the best time in the day is the early morning, after "chota haziri." Many take horse exercise where circumstances permit of this, and this is certainly the best and most exhilarating form. Should the early morning not be available, the exercise should be taken in the evening. One should never go out in the middle of the day. After exertion the nurse must take care never to get chilled.

(*d*) *Precautions at Night.*—The chief precaution to take is to avoid being bitten by mosquitoes, which have now been proved to be so hurtful in the propagation of disease. This is carried out by the use either of mosquito curtains, and here it is necessary to urge that these should be tucked in under the mattress and not hang on to the floor weighted at the bottom; or by punkahs, the flounce of which should have its lower border about one or two feet only off the face. When sleeping under a punkah the cholera belt must never be left off. Should the heat be very intense, much comfort can be obtained by sleeping on some matting.

(*e*) *Other Points.*—It would be well to take out a waterproof sheet, as these are expensive in the tropics: a hold-all for one's bedding, such as can

be obtained at the stores; a pillow and a good blanket. Lastly, the nurse should be cautioned never to bathe in cold water, but always in warm. I have only known one officer during my 20 years' service that was able to stick to his cold bath. My own experience is doubtless similar to that of many. After some months in the country I found I had a most troublesome pain in my right side, and on taking medical advice was at once asked if I took cold baths. On replying in the affirmative I was advised to take warm, when the pain, doubtless due to congestion of the liver, at once disappeared.

CHAPTER II.

HEAT-STROKE—PRICKLY HEAT.

In treating of the various tropical diseases and the duties of the nurse as regards them, I propose with each disease to narrate shortly their clinical symptoms, then to discuss the facts of their causation which it is desirable a nurse should know, as without such knowledge she cannot possibly understand how to prevent them, and finally to discuss the preventive and nursing treatment of each.

1. Heat-stroke.

The first enemy to health that an immigrant into the tropics encounters is heat, and therefore we will begin our subject with the effects of heat. Now the heat of the tropical sun will be always more or less present; we must know something, therefore, of what it will cause and how to prevent its bad effects; for, should an intending worker in tropical climates be incapacitated at the outset of his or her career, the ambition of those entering on a tropical life may be at the beginning frustrated, for once you are attacked by the sun, ever afterwards you will be more liable to further attacks.

Clinical Varieties of Heat-stroke.

The sun's rays may affect an individual in more than one way. The subject will best be considered under the following heads: *A*. Heat Collapse; *B*. Heat-stroke; (*a*) Direct heat-stroke or sunstroke proper; (*b*) Indirect heat-stroke.

A. Heat Collapse.—Here the patient suddenly turns giddy and falls. His skin is moist and cool, his breathing hurried, but never stertorous, the pulse small and soft, the pupils dilated, and the temperature at or below the normal; there is also no complete loss of consciousness.

B. Heat-stroke: (*a*) *Direct Heat-stroke or Sun-stroke.*—There are several varieties of this form. (1) In one the sufferers are chiefly unaccustomed to the fatigue of marching, and they are particularly liable to be seized by it when the skin does not perspire well, as when the air is moist; after the onset of violent headache, the patient continuing his march, falls down in convulsions. Insensibility is absolute, and often incontinence of urine occurs, he has difficult respiration, and his teeth are firmly clenched. (2) In another the subject streams with sweat, becomes paler and paler, with swollen veins, injected eye, quick and shallow respiration, and at length falls to the ground. Consciousness is not generally entirely lost, and if the patient be laid down, and his respiration be relieved of all impediment, revival occurs. (3) The patient becomes extremely thirsty and suddenly falls forward comatose. (4) The patient, after a hot march, is seized with a raking, splitting headache, hourly becoming more and more intense until the greatest agony is experienced. With this there is intolerance of light, and unconsciousness sets in. Should this be recovered from, the intense pain in the head will last without cessation for from six to eight weeks, the only remission being at sundown.

(*b*) *Indirect Heat-stroke.*—Here the patient is not attacked in the open, but in his hot, close bungalow. He becomes pale, there may be nausea, colic, and incontinence of urine. Next follow convulsions, with cyanosis dyspnœa and insensibility. The breathing is stertorous, the pupils contracted, and the temperature of the body may reach 108°

to 110° F., and remains high for some time after death.

Such are very briefly the clinical signs of the effects of the tropical heat on patients who are affected by it.

Etiology.

Several theories have been put forward to explain the occurrence of heat-strokes, such as: (1) The caloric theory, which attributes the attack entirely to the action of intense heat. (2) The poisoned-blood theory, according to which the heat causes the blood to become poisonous to the nerve cells. (3) The microbic theory, or that theory stating the symptoms are due to the action of a microbe. (4) The theory that the actinic rays of the sun cause the attack. This last theory, in my opinion, is the correct one, as I shall proceed to show.

Preventive Measures.

1. *Alcoholic drinks ought never to be taken when exposed to a hot sun.* Tea and coffee are the drinks *par excellence.* The sun's action diminishes the action of the skin, lessens nervous activity, causes less carbonic dioxide to be exhaled, and induces cardiac paralysis. Now the action of tea and coffee, as stated previously, is exactly the reverse to all the above; they also counteract the onset of fatigue, so deadly a factor in heat-stroke, and hence are clearly indicated when much muscular exertion is undertaken. Hence, if a nurse has to make a journey in the heat of the day, let her fill her water-bottle with cold tea.

2. *Dress.*—As to the head-covering, the nurse should first of all remember never to go out in the sun with her head unprotected. As regards the best form of headwear, she should possess for the day one of the numerous forms of solah-pith topee—the uglier they are in shape the more efficacious they commonly are—but with a puggaree around them

they may be made presentable. They can be obtained in India; for the voyage out a double Terai hat should be purchased, as this is a very comely article to wear in the evening in the tropics. An excellent form of topee to get is that known as the "Cawnpore tent club helmet," purchasable at Cawnpore and other places. She should also wear neutral-tinted spectacles, these afford the greatest relief to the eyes from the glare. She should have a woollen pad sewn into the dress over the spinal column. The dress itself should be loose round the neck and chest. The best material is of light wool, the latter being but a slow conductor of heat and does not get saturated with perspiration like cotton. The advantage of not having one's dress to fit tightly is well shown by an instance quoted by Surgeon-General Sir A. De Renzy. At the capture of Rangoon in 1852 "of two sets of men who were alike "in all other respects, one fought in shirt sleeves "under an intensely hot sun, the other in blue cloth "tightly fitting coats; many of the latter began to "drop down insensible shortly after coming into "action, their commanding officer being amongst "the number."

I have said previously that the theory of heat-stroke that seems to me to be the correct one is the chemical one. To explain this it is necessary to describe the effect of the passage of the sun's rays through a prism. After passing through a prism the sun's rays are split up into what is termed a spectrum, which consists of a band of the following colours in order—namely violet, indigo, blue, green, yellow, orange, red. This is the visible part of the spectrum, for beyond it at either end we have evidence of rays which are invisible, namely beyond the violet end there are rays known as chemical or actinic rays, from the effect they have in decomposing certain salts, as nitrate of silver as in photography. The chemical action of light

chiefly depends on these so-called actinic rays. Beyond the other end of the spectrum are what are known as the heat rays. Now any fabric dyed red or orange will filter off the actinic or chemical rays.

An officer well known to me had suffered from sun-stroke in the Afghan war and had three subsequent attacks in India. As each hot weather came round he was affected with severe headaches on and off, until one day he had the good fortune to read a letter from Major F. N. Maude, R.E., in the daily paper. This officer had had repeated attacks of sun-stroke, and he formed the idea that the dangerous rays of the sun in this respect were the actinic rays, which pierce practically through anything except always a layer of colour interposed as a filter. Dark red or yellow is such a colour, as every photographer knows. He therefore used a red or yellow lining to his hat and coat, precisely for the reason that a photographer develops his plates under red or yellow light. The result was that he no longer felt the sun, and remained free from its ill-effects, except on one occasion when a brother officer removed this lining unknown to him from his helmet, when he was seized with severe headache and the initial symptoms of sunstroke on going out to his work shortly after. My friend followed the same line of treatment and never afterwards felt the sun. He told several people of this and they also had the same fortunate experience. Hence the nurse should line her helmet with red flannel, and also cover the pad down the inside of her dress over the spine with red. So much, then, for the question of prophylaxis. As regards the actual treatment of a case, the patient should be moved into the shade and his clothes opened about the neck. Cold water from a "mussack" should be poured on to his head and neck. Ammonia should be applied to his nostrils. The douche is to

be repeated until a favourable effect be produced. A turpentine enema should be given and a large mustard poultice applied to the chest. The late Dr. Norman Chevers strongly advocated "planing" the head with ice. This, however, should not be done when the skin is cold and the pulse feeble. The attending physician will give his directions to the nurse as to the carrying-out of these measures.

This lecture, it will be seen, has been chiefly occupied with the measures the nurse herself should take as regards the prevention of heat-stroke. But these of themselves are of chief importance, in order that her services may be retained intact for the benefit of her patients from other tropical diseases.

2. PRICKLY HEAT.

Another affection for which heat is responsible is prickly heat. It is generally held to be a minor ill, and moreover the unfortunate sufferer from it is considered to be lucky in that he is less liable to the more severe diseases of the tropics. This, however, is poor consolation at the time to one experiencing the maddening irritation induced by the condition, for the distress may be so acute that the term "maddening" can in truth be only applied to it. It is also one usually considered a minor ailment, not causing anxiety, so that very often a doctor is not called in. Hence it is well to know the best means of allaying the intense irritation, and a nurse may thus render valuable comfort to the sufferer.

Nature of the Affection.

The skin amongst other structures contains two sets of glands, the sweat glands and the sebaceous. Many authorities hold that it is directly connected with the former, but Pearse of Bombay dissents from this view, and considers the latter are the culprits. His view is that there is an acute distension of the

sebaceous glands by their own secretion primarily, which is maintained in a more or less acute and active state by the continued irritation of excessive perspiration, and his treatment, which certainly seems to be more successful than the usual methods, is based on this view. It has, as usual with a number of tropical diseases, been asserted to be a form of malaria; but, of course, it is not.

Features of the Affection.

New arrivals are most liable to the affection: it will very likely be first experienced in the Red Sea on the voyage out to India. The eruption consists of small bright red pointed discrete papules, placed close together, mingled with a few vesicles. It occurs most on the front of the chest and abdomen, the back, shoulders, and arms, and less often on the face and legs. Pearse points out that it is distinctly limited to those parts of the skin containing sebaceous follicles. Large areas of the body are affected. The rash appears quickly, with profuse sweating. The itching is intolerable, and provokes much bad language! Often one sees a very fine desquamation superseding on the parts. Occasionally the itching is so intense that sleep may be disturbed. The duration is from a few days to months; should a few days of cooler weather intervene, relief will occur.

Treatment.

(*a*) *Prophylactic.*—As has been remarked above the affection is considered a minor one, the doctor may not be called in. It is well therefore that the nurse should know what to advise if asked to do so. First of all, anything exciting perspiration, whether we consider this as causing the affection, or as keeping it up, must be avoided. Thus all hot drinks should be eschewed, such as a cup of hot tea, which, in my experience, is one of the surest things to bring on an

attack on newcomers. Close rooms are contra-indicated. As regards the clothing, Pearse advises cotton next the skin, and recommends an openwork cotton. Here, however, I feel bound to dissent from him. It has before been shown that cotton should not be worn next the skin. This becomes sodden with perspiration, and is in my experience in no way any precaution against prickly heat. Light woollen merino is the best to wear, this absorbs the perspiration quickly, so that the skin never becomes sodden.

(*b*) *Curative.*—Supposing a medical man be not called in, it may very often happen that a nurse may be in the bungalow, etc., and be asked her advice as to alleviating the intense itching. Various remedies have been advised, but in my experience none can equal bathing the irritated parts of the body with water containing "washing soda." I had been recommended to try many applications, but the latter was the only one that effected any relief to me. This was, however, before the appearance of Dr. Pearse's paper on the subject, and the method he recommends appears to be the best hitherto advocated. It will not, as he says, cure; for if you leave off the treatment the disease will return in a day or two, but it is a means of affording the very greatest relief. The nurse should therefore advise the patient, in cases where her advice is sought, to anoint the body with oil for the purpose of protecting it against the irritation of the exuded sweat. This also keeps the skin soft. Various preparations can be used. Pearse recommends a mixture of almond oil and lanoline in the proportion of 8 to 1, with some ol. rosæ. Major Moore, R.A.M.C., has used with great efficacy fresh cocoanut oil. Most people in the tropics look upon this as a nasty product, but if fresh it has only a very faint smell, which disappears when it is rubbed into the skin. It is recommended to apply it before going out for the evening's exercise. You

strip, pour a little oil into the palm of the hand, and rub it over the body from the neck to the ankles, getting your servant to do the back. Do not use a sponge or rag, as they are not easily cleaned and soon get offensive (Moore). Soap should be avoided, as " this removes the sebaceous matter from the surface of the skin, the sebaceous glands are thus unduly stimulated to produce more secretion, while at the same time the excessive perspiration is also irritating them to lubricate the surface " (Pearse). As a further aid, dusting powder is most valuable. When no other is handy fine Indian corn meal can be applied.

In concluding the account of these methods of warding off prickly heat, I must state that I have had no personal experience of the latter procedure, as it had not been advocated when I left India, but there can be little doubt that these oily preparations constitute the best means of preventing the distressing attacks of this affection.

CHAPTER III.

THE PROCESS OF INFECTION—ENTERIC FEVER.

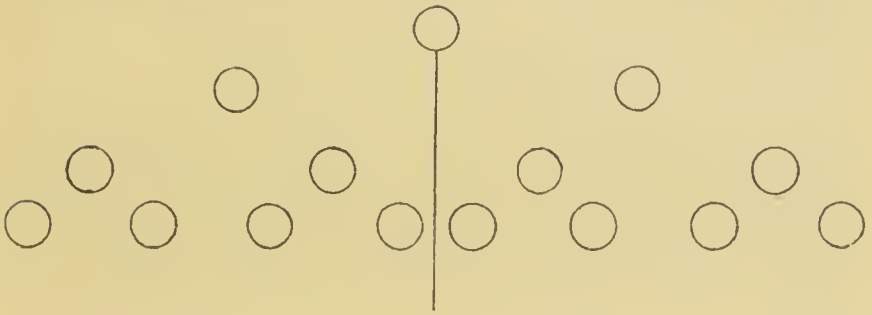
The Process of Infection.

We now must consider the nursing of those diseases in the tropics that are communicable from one patient to another. This process of communication is due to the agency of the lower forms of animal and vegetable life—for example, amongst the latter we have the germs of typhoid fever, of relapsing fever, of cholera; amongst the former we have the amœba of dysentery, the trypanosoma of sleeping sickness, and the sporozoon of malarial fever. We may profitably begin this part of our subject therefore with a short account of the life history of germs.

Germs.—These may be either small spheres, when they are known as "cocci," or may be straight or curved, when they are known as "bacilli." A third class is that of the wavy filaments, classified as "spirilla." Under the microscope they may be seen scattered without any definite formation, or arranged in pairs (diplococci), or in long chains (streptococci), or in collected masses (staphylococci).

Mode of Growth.—These minute organisms propagate themselves in the following ways: in one method a division occurs along the middle, so that the original germ separates into two, and these again

subdivide, each subdivision becoming a separate organism, as is shown in the following diagram : —



The process is a very rapid one. Cohn states that in twenty-four hours a single organism may produce a progeny of sixteen millions. Another method is by spore-formation. Here small rounded spots appear in the germ, which then breaks up and liberates the spores, each one of which becomes a new organism.

How do the Organisms Produce Disease?—The healthy tissues of the body are able to offer great resistance to the attacks of these minute forms of life, but only a slight chemical or physical change is necessary in the vitality of a part to lay it open to attack, and a germ can then cause disease in the following ways :

1. Mechanically by obstructing the performance of the different functions of the tissue.
2. In their growth by depriving the tissues of oxygen.
3. By acting as a poison to the tissues.
4. By producing poisons or toxines.

The body itself possesses the power of counteracting the attacks of these germs, in that the blood contains a certain set of cells termed " leucocytes," which have amongst their properties the valuable one of overcoming these enemies to the health of the individuals. Should, however, the germs be in excessive number, and potent enough to overcome their resistance, then the body will become infected.

The resistance of the body to the action of germs varies with the individuals; some people pass unscathed through an epidemic, others soon fall victims. The resistance to the various diseases is known as "immunity."

Now many conditions will either increase or diminish the potency of these germs to do evil. Of late years methods have been discovered by which the vicious qualities of the organisms can be so modified as to render them capable of neutralising the attacks of the same when the human body is exposed to them; in fact, antitoxins are formed. The antitoxin treatment, as we shall see, is of the greatest value as regards prophylaxis in cholera and enteric fever.

How do Germs Enter the Body and Infect the Individual?—Unfortunately manifold are the paths of entry of these organisms into the human frame. To mention a few of them, they can infect by the food and liquids we swallow or by the air we breathe. They can be conveyed thus by infection from the excreta, fæcal and urinary; by the tropical dust; they can be conveyed by infected clothes and bedding; whilst a notable instance, as will be shown later, demonstrates that they can gain admission through the medium of "jairans" or dusters. It is thus seen how necessary in the preventive treatment of infectious diseases are well considered plans of disinfection.

ENTERIC FEVER.

The subject of enteric fever is perhaps the most important one in the whole range of medicine as regards nursing; for in this disease a good nurse is invaluable, and in no disease is efficient nursing more demanded. In the absence of any of the sudden complications requiring skilled medical aid, an able nurse is far more important than the medical attendant.

This affection is one of the most frequent and most serious to be met with in India, and in consequence of its excessive prevalence, from time to time various curious theories have been held to explain its frequency. These, however, need not detain us. At one time, strange to say, it was considered by the authorities not to exist in India at all. In 1853 it was discovered by Scriven at Lahore in Europeans; in 1856 it was found amongst the natives by Ewart in the Ajmere Jail; and in 1859 it first obtained a place in the statistical returns. There has, until of recent years, ever been the opinion that natives were scarcely affected; but this has, since the employment of the Widal test, been shown to be erroneous. No race or creed is exempt. The merit of demonstrating its frequent occurrence in natives is due to chiefly Wright of the 6th B.I., Elliott of Madras, Buchanan of Nagpore, and Leonard Rogers of Calcutta; the latter indeed stating that over 80 per cent. of the cases of continued fever, lasting as long as three weeks, proved to be enteric fever on using the Widal test. The application of this test has in truth revolutionised our ideas of the occurrence of this fever amongst natives. There is much controversy in India as to the method by which this affection originates; the consideration of this, however, need not take up our time; suffice it for the nurse to know that enteric fever may be communicated by the ingesta, by the excreta, by flies, and by dust. To emphasise these points, a few examples may be quoted. One need not mention cases caused by the ingesta, as these are well known; nor need one emphasise the part played by the solid excreta, beyond stating that by this time the soil of India must be fairly impregnated with the bacillus of Eberth. And be it recollected that the bacillus is possessed of great vitality. Cayley records a case where the typhoid stools were burnt in a dunghill. Some five weeks after five persons were

employed in removing dung from the heap, and were attacked with enteric. Their alvine discharges were buried deeply in the same heap. Nine months subsequently two men were employed in the removal of the heap, one of whom was attacked with enteric fever and died. But besides the solid fæces, the urine is a fertile source of conveyance, as shown by Dr. Horton Smith in his Gulstonian lectures. And here the nurse should remember that the specific bacilli persist in the urine long after the defervescence of the fever. For instance, Dr. Lazarus has found them 41 days in the urine after the temperature had attained the normal. Dr. Petruscky gives a very illustrative case, showing how the urine can be infectious in man. The sister of one of his wards accidentally drank a small quantity of urine which had been passed by a typhoid fever patient into a wine glass, and after an incubation period of 14 days she developed typhoid fever. Urine is probably one of the most frequent causes by which the soil of India is contaminated.

A fertile source of infection is through the dust. Anyone who has experienced a dust-storm in India knows how difficult it is to keep it out of one's bungalow, and should the dust be infected, one can understand how this, being blown on to the food therein, will infect it in its turn. At Quetta in 1898 an epidemic occurred. No case was admitted until May, when the usual dust-storms began. The outbreak was preceded by sore throat from the dust, and several cases began with sore throat. The filth-pits were to windward of the barracks, and the epidemic was worst in the lines nearest the pits. Again, in an epidemic at Lundi-Kotal, in the Khyber Pass, the affection began in June, when the dust-storms commenced to rage. At the end of July, when the excreta were removed for disposal one and a half miles from camp, the epidemic began to cease. As regards the agency of flies, their importance was

well shown in the Spanish-American war of 1898. A Commission was appointed to examine into the causes of the great epidemic that had occurred, and it stated that "flies were undoubtedly the most "active agents in the spread of typhoid fever. Flies "alternately visited and fed on the infected fæcal "matter and the food in the mess tent; typhoid fever "was much less frequent among members of messes "who had their mess tents screened than it was "amongst those who took no precaution." Again, in our South African war flies swarmed everywhere, and seemed to be particularly attracted by the enteric fever tents, and our medical staff held they were active agents in the dissemination of the disease. It is needless to state what an ever-present plague they are in India, especially in the hot weather. Before concluding the subject of the methods of transmission, it may be mentioned that much evidence has been given of late years, especially by Dr. Collie, of the Homerton Fever Hospital, that enteric fever can be contracted by direct contagion. With these preliminary remarks let us now pass on to the actual nursing of an enteric fever patient and its clinical course.

Clinical Course of Tropical Enteric Fever.—The nurse must not expect to see this fever run a course similar to cases in temperate climates. This fever should always be held in mind when anybody has had a temperature uninfluenced by quinine for a week. The temperature, as before remarked, does not show the usual type of enteric fever at home as a rule. Other differences in the course of the fever are the following: *Diarrhœa* is less marked, and often occurs only at late periods in the third or fourth week; the *rash* is stated to occur less frequently; *the characteristic tongue* is not so often seen; *gurgling* and *abdominal tenderness* are less frequently observed; *cardiac failure* and *severe pulmonary complications* more often occur; *throm-*

bosis of the large veins is said to be met with more often; the *onset* is perhaps more rapid.

THE NURSING OF AN ENTERIC FEVER PATIENT.

During the evolution of enteric fever the chief stress falls on the structures known as Peyer's patches in the small intestine; these become inflamed and swollen, and slough; when the slough is cast off ulceration is left behind, which, as the case goes on to recovery, heals up. But on the other hand the sloughing process may not cease, but extend deeply through all the coats of the intestine, during which hæmorrhage may occur from a small artery being laid open; as the extension goes on, perforation finally occurs into the peritoneal cavity. Hence the nurse should always bear this danger in mind; and hence the necessity of the careful regulation of the diet, and the avoidance of all unnecessary movements of the patient.

(*a*) *Management of the Sick-room.*—This must be kept as cool as possible; in the hot weather you cannot keep your windows and doors open, as the room will become unbearably hot: punkahs, and thermantidotes where available, will, of course, be in use. The patient should wear a thin night-shirt, best made to open down the back, and fastened by tapes. The bed-clothes should be light, consisting of a sheet only over the patient; a blanket is not necessary, as there is no fear of catching cold. In the Punjab and North-West, should the disease be contracted in the cold weather, during convalescence the bed-clothing must be increased. The cummerbund should be worn. The pulse and respiration rates will, of course, be taken, and the temperature range noted; the latter should be taken every four hours. And here it may be remarked that the nurse will not in my experience see the range exhibited

after the manner of cases occurring in a temperate climate. This range is, in the cases I have seen, very exceptional. The temperature in India follows no very settled course, but on the whole may be described as irregularly remittent.

(*b*) *The Question of Feeding.*—This is of the greatest importance. The attending physician will order the quantity; the nurse should be careful never to give the patient a large amount at one time. Milk, if it agrees, will form the diet, and here the nurse must carefully watch for the appearance of any curds in the stools, for if present they indicate that it is not being properly digested, and the physician must be informed of this at once. With regard to the food, Dr. Hale White has pointed out that the usual amount of milk ordered—namely, 3 pints in the 24 hours—does not supply the necessary amount of calorics of energy per diem. (A caloric is the amount of heat necessary to raise one kilogramme, or 2.2046 pounds, of water from zero temperature C° to 1.C°.) Three pints of milk only supply 1,350 calorics of energy; he therefore recommends that in addition a tablespoonful of maltine or honey should be given four times a day, for this quantity of maltine supplies 120 calorics; hence, by giving four tablespoonfuls you give 480 calorics, or, with the milk, 1,830 calorics; this is practically sufficient, for a patient should have enough food to give him 2,000 calorics of energy per diem.

Should masses of curds be found in the stool, the milk should be given peptonised, or the milk may be converted into whey, by boiling each pint of milk with one or two tablespoonfuls of lemon juice, and straining through muslin, strongly squeezing the curd. In this process, however, we lose the albuminous constituent in the curd, but to make up for this you beat up a new laid egg and add it to four ounces of the whey, about three times in the day.

Dr. Burney Yeo has drawn attention to the fact that in very many cases milk will not agree with enteric fever patients, as shown by their vomiting a firm cheesy mass soon after taking the milk, or by the continual passage of motions with masses of curd in them. Under these circumstances the milk should be tried after diluting it with twice its quantity of water; if it still disagrees, freshly made clear soup may be administered, or dilute albumen water made with white of eggs (the whites of two eggs with one pint of water, foamed up and strained). He narrates one very severe case complicated with alarming hæmorrhage, in which the patient was fed on one teaspoonful of Valentin's meat juice in a wine glassful of cold water every three hours with one teaspoonful of brandy. This was the only diet given for seven days, and answered admirably. These points are, however, only mentioned to complete the subject of feeding, as, of course, the doctor himself will give all the necessary orders for the method and lines of feeding. With regard to stimulants, in my experience they are more often called for in the tropics than in temperate climates.

In concluding our remarks on diet, it may be mentioned that unless the patient is in a state of stupor he need not be awakened if sleeping. He may be allowed to drink freely in the intervals of his "feeds" of water, or of home-made, not bazaar-purchased, lemonade from which the pips have been strained.

Before proceeding to discuss the general nursing of the patient, I would direct attention to the especial dangers that are imminent over an enteric fever patient, namely hæmorrhage, perforation of the bowel and its consequent peritonitis, and cardiac collapse, which, in my experience, has been more frequent in cases in the tropics than in those in temperate climates.

As regards *hæmorrhage*, Murchison found it to

occur in the largest number of cases in the third week, so that the nurse should bear this in mind. It will be shown to have occurred by a sudden increase of the prostration, pallor of the surface, increased frequency of the pulse, and a sudden fall in the temperature. If the hæmorrhage be large in amount it often brings on fatal collapse, or may be followed by perforation; if small, it is not of so much consequence. With the onset of these symptoms the nurse should at once apply ice to the abdomen, and the best place to apply it is over the right iliac region; a waterproof sponge-bag will make an efficient vehicle for the ice. The patient should be given ice to suck, and be kept perfectly still. Further directions will be given by the doctor, who should be at once summoned. It must be remembered that the blood may be retained in the bowel and not appear in the stools. Lastly, if there are signs of collapse, the foot of the bed should be raised.

Perforation will be indicated by the sudden onset of severe abdominal pain increased on pressure, quickening of the pulse, rapid lowering of the temperature, vomiting, and an anxious, altered appearance of the facies. Complete rest must, of course, be enjoined, the fæces and urine being directed to be passed into the draw-sheet, and not into the bed-pan, thus avoiding any movement. The bed-clothes should be kept off the patient by a cradle, band-box, or pillows. No food to be given by the mouth, but entirely by the rectum. Ice may, however, be sucked. The doctor should be sent for at once. This distressing accident occurs most frequently in the third, fourth, or fifth week of the disease.

Peritonitis may arise also without perforation. Here the doctor will order the necessary remedy; it may be mentioned that hot spongio-piline is more easily tolerated than poultices by the patient.

Cardiac Collapse.—This, as remarked above, is

found more frequently in the tropics than in temperate climates. It is perhaps commoner in the third week. The respiration becomes quickened, is very distressing, and sighing in character. The impulse of the heart is very feeble and diffused, or may not be perceptible. The necessary directions will, of course, be given by the physician. I well remember a case of a brother officer who was nearly at the point of death from collapse, so much so that arrangements were made for his funeral in a few hours' time, it being in the hot weather. He was literally rescued from the jaws of death by the frequent administration of the subcutaneous injection of strychnine over the cardiac area.

Let us now consider the general nursing of the patient. Attention has already been drawn to the points relating to the room in which the patient lies and his feeding. First of all the enteric fever patient, it is needless to say, should be kept at perfect rest, this more especially in view of the dangers we have just been considering. The bed should not face the window, as this distresses him. He should never be allowed to raise himself for the purpose of getting anything from a table or chair by the bedside; but the nurse from time to time should carefully change his position in the bed, so that pressure be not constantly exercised on one part of his body, and thus occasion bed-sores. The occurrence of a bed-sore is generally a subject of reproach to the nurse. To obviate their appearance, the body must be kept scrupulously clean; it should be washed entirely night and morning, as this is most grateful to the patient. Any soiled bed-clothes will be removed at once. The mattress must be firm and elastic—a spring mattress with a horse-hair one over it is the best—and the bed-clothes kept free from creases and bread-crumbs. The skin must be ever kept completely dry, the draw-sheet should never be left wet, and

this will have to be carefully looked after where there is incontinence of fæces and urine; in this latter case it is advantageous to anoint the skin with some greasy application such as lanoline or zinc ointment.

The usual sites for a bed-sore are the buttocks or hips, but they may occur anywhere. The skin in the above especial parts should be protected from the first day of the fever by rubbing it with—night and morning—spirit, such as brandy or eau de Cologne, or Friar's balsam, and then painting with collodion. The back must be examined once a day, and if any redness of the skin be discovered, then at once change the position of the patient, and let him lie on a circular pad or water-bed, and report the occurrence to the medical attendant. Should a bed-sore, in spite of all precaution, form, the nurse should keep the dressings ordered on by strapping, as bandages are apt to ruck up.

The mouth and nose should be looked after with care, as secretions are apt to dry and cake on them in hot climates especially. Hence, frequently during the day and night, and especially after food, swab out the mouth with some weak antiseptic lotion. The teeth must be brushed morning and evening. If the mouth is not regularly cleaned, inflammation may arise, spreading through the Eustachian tube to the ear or down the larynx. Look out for any excoriation on the lips and tongue, and, if present, report to the medical attendant. If the mouth is in a good condition the patient will take his food far more readily.

The temperature should be taken at four-hourly intervals. Any sudden rise or fall must be at once reported. But inasmuch as a continued high temperature is largely responsible for the wasting and exhaustion of the fever, many authorities give directions that, as soon as it reaches 103°, measures for reducing it should be adopted, such as sponging the

body, or applying iced water compresses, frequently changed, to the body.

In America the cold-bath treatment is by many practised. Thus, Osler states that for many years it has been his practice to give a bath of 70° every third hour when the temperature was above 102.5°. The patient remained in the bath for fifteen to twenty minutes, after which he was taken out, wrapped in a dry sheet, and covered with a blanket. Whilst in the bath the limbs and trunk are rubbed thoroughly. Food is usually given, sometimes with a stimulant, after the bath. The mortality by this treatment certainly appears to have been lessened. Thus at Brisbane Hare reduced his mortality from 14.8 per cent. to 7.5 per cent.

As it is unusual to find a bath in the tropics in which a patient can lie at full length, mention may be made of an apparatus contrived for this purpose by Henderson, of Shanghai. This consists of a long bamboo settee, used by the natives of China, in which the cross-bar at the lower end is removed to make way for the bucket to catch the water as it runs away. Underneath the seat of open bamboo-work a receiver of some waterproof material is fastened by tapes tied along the side of the couch, and sloping towards the lower or bucket end. The water is then continually poured over the patient, who is stripped and covered with a sheet. This was invented by Henderson for the treatment of sunstroke, but can be used for the bath treatment of enteric equally well.

Another method is the "bed-bath." Around the edges of the bed are placed rolled blankets, and over these a rubber sheet, into which two or three pailfuls of water are poured. The patient is placed in the trough thus formed.

Points relative to the excreta.—If there be more than four motions per diem the matter should be reported to the doctor, who will give his directions.

If there be constipation this should also be brought to his notice, but on no account should the nurse give purgatives without orders. The stools should, whenever passed, be examined for curds, in order to see if the milk be duly digested, or for sloughs. They should be covered over and saved for the doctor's inspection. Where there is incontinence of fæces pads of absorbent wool, sprinkled with some antiseptic powder and enclosed in butter-muslin, should be placed beneath the patient, and burnt immediately after removal. The method of disinfecting the stools will be described later on.

As regards the urine, there may be retention, which, of course, must be brought to the visiting physician's notice. After the catheter has been used, this must be scrupulously cleaned and sterilised. Where there is incontinence of urine this must be reported, and especial care taken as regards bed-sores, all soiled clothing being at once removed. The bed-pan must be used from the first, and care must be taken not to bruise the patient with it.

Tympanites is best met with by the application of the turpentine stupe or by the long rectal tube. Sir Wm. Jenner used to direct a flannel roller to be placed beneath the patient, then a double layer of thin flannel, wrung out in very hot water with a drachm of turpentine mixed with the water, was applied to the abdomen and covered with the ends of the roller.

Epistaxis.—This may be troublesome. When it appears the nurse should raise the patient's head on a pillow, and bathe his forehead and nose with ice-cold water. Should this not stay the bleeding, the doctor may have perhaps to plug the nostrils.

Lung Complications.—We usually find a certain amount of bronchitis in a case of enteric, and this may cause much sleeplessness from the constant cough. A more formidable complication is pneumonia. Where this occurs we must not allow the

patient to be continually on his back, as by so doing the lower parts of the lung become much congested, and a hindrance to the necessary amount of air arises. Hence, the nurse should be directed from time to time to change the position of the patient in bed, first turning him on one side and then on the other, supporting him in the required position by pillows.

Phlebitis is more likely to complicate enteric fever in the tropics than in temperate climates. The veins of the lower extremity are most usually affected. When this occurs, the nurse will find the leg swollen and tender, these symptoms having appeared more or less suddenly. The nurse must impress on the patient, if sensible, on no account to move the parts, lest a portion of the clot be loosened from the vein into the circulation, when sudden death might occur. The limb should be elevated and bandaged carefully, beginning at the toes.

Tender toes.—Handford describes a curious condition of the toes, which become extremely tender at their tips and pads, so that the weight of the bed-clothes cannot be borne. It has been found most common after the bath treatment. The nurse should take off the weight of the bed-clothes here by a cradle.

Mental symptoms.—There may be extreme restlessness on the part of the patient. In such a case one nurse must give her undivided attention to the patient. Padded boards should be fixed to the sides of the bed to prevent him falling out.

Treatment during convalescence.—As regards food, the usual *rôle* is to keep the patient on to his fluid diet for ten days after the temperature has fallen to the normal. The nurse's attention must be ever on the watch to ensure this, for as the fever ceases the appetite of the patient may become ravenous. I well remember a case in my student days in which, unknown to the nurse, a friend on

the visiting day at the hospital brought a patient an orange. Next day she was seized with peritonitis, with a fatal result. At the post-mortem an orange pip was discovered in the peritoneal cavity, together with the perforation through which the pip, and with it her life, had passed. After the period of ten days the diet is cautiously increased under the direction of the doctor. During convalescence the nurse must also be on the look-out for complications, such as phlebitis and bed-sores.

Woodbridge Treatment of Enteric Fever.—This treatment is recommended by Dr. Woodbridge, of America, who quotes a case-mortality of only 1.90 per cent. amongst 7,857 cases of typhoid fever, and an average duration of illness of only 12.7 days has been tried in India. Briefly, the treatment is "a general or intestinal antiseptic and eliminant "one, and consists in giving very frequently (every "fifteen minutes during the wakeful portion of the "first forty-eight hours) small doses of varying "formulæ of podophyllin resin, and calomel, com-"bined with such antiseptics as guaiacol carbonate, "menthol, eucalyptol, and thymol, the indications "being to produce free evacuation as early as pos-"sible, and by subsequent varying doses to keep the "bowels regular. The maximum number of doses "in the twenty-four hours, supposing the patient "not to sleep at all, would be ninety-six."

Major Hendley, I.M.S., who has tried this method, states that he never succeeded in getting down more than seventy doses in twenty-four hours. His experience was favourable; but one does not know which to pity the most in this method, the unfortunate patient who has to take his medicine every quarter of an hour, or the unfortunate nurse who has to administer it, more especially if the patient be refractory.

We will now consider the methods of preventing the spread of enteric fever that should be carried

out by the nurse, both as regards infection generally and infection of herself.

A. Measures to Prevent Infection Generally.—The enteric bacillus gains an entrance into the body through the digestive canal, being swallowed with food or drink, and occasionally through the lungs. Once swallowed, it multiplies in the bowel, and in so doing causes the changes in the intestines of which mention has been made, and then leaves the body again by the stools and urine. When it has entered by the lungs the bacillus will be present in the sputum coughed up; when it leaves the body by the excreta it may infect the bed-clothes, the utensils receiving the discharges, the hands of patients and of the nurses, unless kept clean and disinfected. It will also, of course, infect any food and drink with which it is brought into contact.

To take the evacuations first. As regards these an antiseptic should be placed in the bed-pan before use. This may consist of a carbolic acid 10 per cent. solution. After the excreta has been passed add some more of the disinfectant, so that the quantity may equal the bulk of the excretion. Thoroughly stir it up, then cover over with a cloth, and let the antiseptic act for at least half an hour before the stool is buried. Other disinfectants that can be used are a $\frac{1}{10}$ lysol solution or a 1-500 corrosive sublimate. This by many is not advised, as it hardens the albuminous material outside the fæcal masses, but personally I have never found any failure from this reagent. The nurse should bear in mind the necessity of disinfecting the urine. The sputum should be disinfected in the same way. After being thus treated, the discharges are to be buried in the earth; the depth at which they are to be buried is variously recommended. Some authorities say at least two feet, whereas the late Dr. Vivian Poore was an advocate for shallow burial; and, in the only instance falling under my observa-

tion of this way of disposal of the fæces, the results were excellent. The best method, however, of treating the excreta is to burn them, mixing them with sawdust. Should the discharges containing the bacillus be thrown on the ground without being disinfected, through the carelessness of the "sweeper," the well in the compound would be infected should the germ reach it. The dangerous consequences ensuing on such a course of action were well shown by the extensive epidemic that occurred in the town of Plymouth in Pennsylvania in 1885. Here a man convalescent from enteric fever was found by the Committee who were appointed to investigate the outbreak to be living in the only house on the banks of a mountain stream of great purity that formed part of the water-supply of the town. Only the people supplied from this source suffered. During the illness of this man his stools were thrown on the snow on the ground within a few feet of the above stream. This was in February and March. At the end of March the snow began to melt, and in April this melting was completed by the occurrence of frequent showers with mild warm weather. The first case of enteric was reported on April 9. Within the next five days thirteen more cases occurred, and then a large increase took place, a great outburst flaring up about the middle of the month. More than 1,000 cases occurred in all.

The stools should be disinfected as soon as they are passed, as their infective properties appear to be developed in about twelve hours.

All utensils, feeding-cups, enema-syringes, etc., used by the patient must be scrupulously disinfected. The soiled bed-linen and dress of the patient must be likewise so treated, and they should be also disinfected at once, lest any infectious particle dry on them, and subsequently be wafted off into the air as dust, and then settle on some food

and infect it. The linen can be put into a large tub and soaked in disinfectant solution, afterwards boiled, and then dried in the sun. Burn all small pieces of linen that may have been in contact with any discharge.

Lastly, we have before alluded to the part played by flies in propagating the disease. They should be kept excluded from the chamber of the sick by attention to the "chicks"; and the stools, during the time they are kept exposed to the action of the disinfectant, before they are disposed of, must be carefully covered over with a cloth.

[As regards the infection that may be carried by the patient himself for some length of time during convalescence by the urine, urotropine in 7-grain doses should be administered three times daily for at least a month.]

B. We now come to the precautions to be undertaken by the nurse herself. A golden rule in the East is never to drink any unfiltered water. The only efficient filters are the Berkefeld and the Pasteur. The Berkefeld Company sell an excellent portable one.

Another method of disinfecting the drinking water is that of Parkes and Rideal, who state that the bacillus typhosus is killed after five minutes' contact with bisulphate of soda in the proportion of 15.5 grains to the pint of water. Fifteen minutes' contact is more advantageous. Firth, however, says that forty-five minutes' contact is necessary in order absolutely to sterilise the water.

The nurse should not wear her nails long, and after attending to the patient in any way, she should always wash her hands well with a brush, and then immerse them in some disinfectant solution for at least five minutes, and then rinse them in clean water. She should always wash her hands and disinfect them before taking her own meals, which must not be eaten in the sick chamber.

Antityphoid Inoculation.—Professor Sir A. Wright has introduced this method of prevention. What is the evidence in its favour? It would appear to me to be overwhelming. The published statistics from six hospitals, for instance, in the South African War—namely, those of the Ladysmith, Princess Christian, Portland, Scottish National Red Cross, Kroonstadt, and Harrismith Hospitals—all concur in showing a much less incidence on the inoculated than on the uninoculated. But an example of the benefit thereby accruing, which is more apposite as far as nursing is concerned, was shown by the epidemic in Maidstone. Here, of 120 nurses who were not inoculated, 16 were seized with enteric, whereas of 84 nurses and attendants inoculated, not one was attacked. As regards the advisability of being inoculated as a preventive against enteric fever, I can only state that if I were again about to embark on a career in India at the age that one enters Indian service, I would most certainly be inoculated myself.

SUMMARY OF THE ESPECIAL POINTS IN NURSING A CASE OF ENTERIC FEVER.

1. Do not pile on bed-clothes. A sheet is quite sufficient protection from cold.
2. From the beginning of the case take precautions against bed-sores.
3. Keep the patient's teeth, nose, and mouth clean with a disinfectant.
4. Remove all soiled bed-linen at once, and disinfect them.
5. Disinfect the fæces and the urine directly they are passed. Let them be exposed to the action of the disinfectant at least half an hour before disposal.
6. Alter the position of the patient in the bed from time to time, so that too much pressure be not exerted on one part of his body.

7. It is not necessary to wake the patient up always for his food if he is sleeping. If he is in a state of stupor his food must be given him.
8. If there be signs of hæmorrhage in the intestine before the doctor comes
   (*a*) Stop all food;
   (*b*) Keep the patient absolutely at rest;
   (*c*) Apply an ice-bag to the right iliac region.
9. Report at once—
   (*a*) If any curds found in the stools;
   (*b*) If any pain in the abdomen;
   (*c*) If any sudden rise or fall of temperature.
   (*d*) If any hæmorrhage.
10. Always wash your hands with some disinfectant after attending to the patient, and before taking your own meals.
11. Do not take your meals in the sick-room.
12. Keep all flies away from the patient.
13. Never yield to the patient's hunger and give him more than he is ordered.
14. The patient should never be left alone.

CHAPTER IV.

DYSENTERY.

The nurse will not be long in the tropics before she has a case of dysentery under her charge. Formerly this was held to be one disease; it is now known that under this term are included several varieties "of intestinal flux, the acute forms characterised by pain, frequent passage of blood and mucus, the more chronic by diarrhœa alternating with constipation and a tendency to recurrence. Usually there is inflammation, and in the chronic cases ulceration of the large bowel" (Osler).

Causation.

Briefly, there are three varieties of the complaint —one caused by a bacterium, one by an amœba, and one the dysentery found in war in which no organism is found, as in our recent war in South Africa. As regards the predisposing causes, we may mention—

1. Season.

In the tropics dysentery is less frequent in the cold season, becoming more common in the months of heat and drought, and commonest of all towards the end of the rains and beginning of the dry season—that is to say, in those months corresponding in temperate climates to the end of summer and autumn. The worst time for dysentery is at that period of the year characterised by extreme fluctua-

tion of the temperature from hot days to cold nights. In Bengal it rages chiefly during the rainy season.

As regards the effect of *atmospheric moisture* or of *rain* and *dew*, opinions are somewhat divided, some authorities holding these factors to be highly important, others holding that they are not so. Hirsch inclines to the latter view. He instances 126 epidemics, 65 of which arose with the wet weather, 61 making their appearance in the midst of continuous dry weather and lasting through it.

2. INFLUENCE OF SOIL.

Where a soil is organically polluted, and dusty so that infection is conveyed by the wind, dysentery is very likely to be prevalent.

3. MALARIA.

There would seem to be an indirect connection with malaria—namely, dysentery is very likely to prevail in the vicinity of swamps and marshes in porportion to the intensity and frequency of malarial fever. The mosquito, however, has not yet been held to convey the disease.

4. CONDITIONS OF THE FOOD.

(*a*) *Impure drinking water.* This has ever been a cause in our campaigns—for example, in the Egyptian War of 1882 much of the dysentery was due to the foul canal water drunk by our men. In our late South African War the Commission on Dysentery and Enteric Fever reported that the most frequent cause of the prevalence of dysentery was probably the drinking of the surface waters, especially those from the rivers which contained a very large amount of mineral and organic matter in suspension. A large amount of disability thus occurred in Lord Roberts' march to Bloemfontein. A third

example may be cited from the medical history of two French regiments of the line. During August of a certain year the 19th and 44th Regiments were barracked at Neuilly. The water was drawn for both regiments from the same source. The 19th regiment drank their water with brandy, the spirit of which precipitated the organic matter contained in it, and this putrefied in the contained vessel. The regiment was attacked with severe dysentery. The 44th Regiment used their water in making tea and coffee, the tannin of which prevented putrefaction. They only suffered from slight diarrhœa. Red wine was substituted for the brandy in the 19th, when the dysentery ceased. Where the disease results from impure water amongst large bodies of men, many patients will come into hospital.

(*b*) *Intoxicating liquors.* Intemperance greatly predisposes to the disease. In war after the capture of a city, unless strict precautions are taken by placing sentries over the wine-shops, much dysentery will ensue.

(*c*) *A monotonous diet* will favour the occurrence.

(*d*) *Salt rations.* In the first Burmese War (1824-26) for six and a half months the troops were fed on salt rations, and 48 per cent. perished principally from dysentery. Here the cattle were, in the first place, marched to Calcutta from distant stations and slaughtered in February 1824 under a degree of heat so great that decomposition must have set in. The flesh was then salted. Again, in the China War of 1840, notwithstanding this terrible precedent, we find the Government had learnt nothing. Cattle were again marched to Calcutta, and slaughtered in the heat of February, with the same consequences to the British troops. The meat was half putrid when the force sailed. In one regiment (the 26th Cameronians), embarking

900 strong and full of health, the result was that at the end of two months there were not 200 men left fit for duty in the field, owing to the havoc made by scorbutic dysentery. But even where the salt ration is not decomposed before salting, we have two evil factors: first, the irritant effects of a salt diet; secondly, the insufficient nutritive power, whilst the salt ration of military life is more highly salted than usual in order that it may keep for two or three years in any climate.

(*d*) *Excessive diet of fresh meat.* Often after raids in Algeria the French soldiers have been seized with this complaint from eating largely of the fresh mutton from the captured sheep.

(*e*) *Tinned provisions.* These, if largely used, as instanced in the Nile Expedition of 1884-86 and in the South African War, will bring on the affection.

(*f*) *Imperfect preparation of grain food.* In Lord Roberts' great Cabul-Candahar march the native followers often arrived in camp too tired to cook their food properly, and so ate uncooked atta and Indian corn. Dysentery followed.

(*g*) *Fruit.* Trousseau held that fruits even when not ripe could not cause the disease. Horton dissents from this. In my experience in Afghanistan fruits played but a small share in the causation of dysentery. An almost unlimited supply of grapes and melons was at hand in the Kurram and Logar Valleys, and I never traced any of the dysentery to this supply.

5. THE INFLUENCE OF FLIES.

Of all living things the fly is probably the most obnoxious. And those only who have been in the tropics know what an obnoxious plague the fly is. In the South African War the myriads of flies in the circumscribed camps were one of the chief means of

spreading dysentery and enteric fever. Infesting the latrines, they carry the infecting material not only on their heads, but also on their bodies, legs, and wings.

6. LONG OCCUPATION OF THE SAME GROUND BY ANY LARGE BODY OF MEN.

In war any camp site should, if the military exigencies of the situation permit of it, be changed at intervals, otherwise the soil will become polluted with the excreta, of men and animals, and bowel affections will inevitably arise. Morache draws especial attention to the effects produced by not changing camp at regular periods. The presence of a large number of men persistently remaining on one spot must inevitably infect the soil, whatever precautions are taken; organic matters from excreta of men and animals are trampled into the earth; foul water from various sources, such as from the kitchens, etc., is also imbibed by the soil, and soon a veritable forcing-bed for zymotic diseases is formed. And how this process must be advanced under a tropical sun! The infection of the soil thus arising is of itself sufficient to start the various forms of bowel complaint, including epidemic dysentery. A good example of this occurred in the New Zealand War in 1864, where, after the occupation of Waikato, several Government officials were employed in surveying the district. They constantly changed their camping-ground and remained perfectly healthy. After a time for protection they were obliged to pitch their camp near the troops, and kept on the same spot. Bowel complaints soon broke out, the more so as their camp was near that of the Land Transport Corps, who had remained encamped on the same spot for some time, and whose camp itself was notoriously unhealthy. As soon as they were

able to do so, the survey party changed their site, and the bowel complaints were at once arrested.

7. NEGLECT OF PERSONAL PRECAUTIONS.

In the tropics, especially on service, a neglect of personal precautions is a fertile source of dysentery. Thus, one should never sleep in immediate contact with the ground. One should always wear the cummerbund at night. Especially is it necessary to sleep under cover where the dew is drenching and heavy. A good example of this was shown in the Egyptian War of 1882, where the Manchester Regiment, under good cover at Ismalia, escaped the drenching dews that the rest of the force not located there were exposed to, and scarcely suffered at all from the bowel complaints which were so rife in the latter.

8. NEWCOMERS IN THE TROPICS

are especially predisposed to bowel complaints, due doubtless to the relaxing effect of the heat on the system. In a previous lecture allusion has been made to the opinions of Laveran and Brydon on this point, so that no more need be said on the subject beyond this—that the nurse should, on her arrival in the tropics, take all the necessary precautions (to be detailed presently) against these affections.

Two examples will fitly conclude this section of the causation of dysentery. In the Ashanti Expedition of 1863-64 great aggravation of the dysentery returns became evident. Out of 210 cases in 1864, 163 occurred in the rainy months—April to July—and out of 32 deaths 26 also occurred at this period. The huts leaked at the Prahsu Camp, rains having set in before the latter was finished. There were vast forests, a river, and dense jungle composing the site of the camp, which gradually

became a swamp. The days were very hot, the nights very cool, and the food of salt meat, biscuits, and bad water. And, again, in the Malay War of 1875-76 dysentery truly scourged our men. In the Buffs the admission rate was 70.11 per 1,000. But two companies of the latter were kept stationary at Malacca; they had no mortality and great immunity from the disease. Why? On account of the light duty, good quarters, no sun exposure, good food, and midday heat tempered by a mild sea breeze: the mortality was 8.34 per 1,000 in the rest of the regiment located elsewhere.

Clinical Signs of Dysentery.

The definition already given by Osler embraces the salient points of a case of dysentery in its acute and chronic forms. It may, however, be pointed out that when a patient who is suffering from a very acute form of the disease rather suddenly loses all pain, the observer must not think from this alone that he is beginning to progress favourably, for this sudden cessation of pain may indicate that gangrene of the intestine has set in, and a fatal termination is imminent.

Before proceeding to the actual details of nursing, the consideration of the stools will first be taken in hand.

Characters of the Stools.

(*a*) The simplest form of stool consists of about a tablespoonful of blood-stained mucus, with a few small clots, and some rounded scybalous matter, surrounded by sanious fluid, or

(*b*) In the milder form of the disease first a solid motion may be passed, covered more or less with greyish or colourless mucus. Next small quantities of offensive mucus with minute fæcal lumps. Then there are passed mainly small quantities of mucus,

stained with fæcal matter, and often mixed with blood. And, in addition, scybala are passed occasionally.

(*c*) In the severer forms, after the bowel has discharged its contents, which are often solid, we find whitish or coloured jelly-like mucus quickly becoming bloody, with often pretty large quantities of clotted blood. The motions are frequent and of about two to three drachms in quantity. This stool forms a slightly yellowish, glairy, quivering mass lying in balls or clumps, without any fæces, or else around a formed mass of fæces. If the discharge be very fluid, the masses of mucus unfold into hyaline shreds—the so-called *shreddy stool*. This type of stool is passed in the first stage of the disease.

(*d*) In a more advanced stage there will be a small amount of yellow fluid, generally without fæces, and containing floating in it a number of reddish lumps, as large as a pea or bean, like raw meat. This stool has been named the *Lotura carnea*.

(*e*) The stool may be *purely bloody*, resulting either from superficial ulceration or from ulceration into a large vessel.

(*f*) In the later stages of the disease we may find a *purulent stool*, due to the formation of submucous abscesses or to destruction of the mucous membrane. The pus is either pure and odourless, or, more frequently, is mixed with fæcal matter and blood.

(*g*) *The so-called frog's spawn or boiled sago stool.* This, although occurring in the acute, yet is mainly seen in the chronic varieties of the affection. It consists of clumps of large hyaline mucus. It is supposed to arise by mucus being pressed into the cavities out of which the intestinal follicles have fallen; this mucus is then modelled in their cavities, and again falls out into the bowel.

(*h*) Sometimes we find with the ordinary stool of dysentery that from time to time the patient will

pass *fluid fæcal matter* throughout the course of the illness.

(*i*) *Green stools.*—In certain cases these are passed. Buchanan, who has drawn attention to this variety, thinks the colour is due to unchanged pigment in the stools, due to the ulceration in the intestine hastening the peristaltic action, and so causing a quicker passage.

(*j*) *Pulpy stools* have been described by Sir Joseph Frayrer. They are very offensive without blood or mucus, and occur in the gangrenous form of the disease.

(*k*) *The gangrenous stool* has a horribly penetrating odour. It consists of a blackish fluid, containing pieces of gangrenous tissue, and sometimes tubular structures, held by some to consist of separated portion of the intestinal canal, but by Heubner of mucus only.

(*l*) *The stools of amœbic dysentery.*—These, which personally I have never seen, are said to be mucoid, with purulent, greyish, shreddy material; greenish like spinach, or pultaceous, with occasionally large necrobic masses; or dark brownish and liquid, floating in which are greyish white masses of the size of a pin's head, embedded in blood-stained mucus. The amœbæ are best demonstrated in the little whitish masses. The earliest stools are small in amount. The odour is mawkish and not offensive. As the disease advances they become more copious, watery, and less homogeneous, with less blood, and much shreddy material. In the periods of intermission, which occur in this form of dysentery, the stools become pasty and even formed, but mucus is still found either mixed with the fæces or adhering to their surface. It only disappears finally after the patient has passed fully formed fæces for some time.

(*m*) *The stools of chronic dysentery.*—These vary much in character. They are thin, watery, of

varying colour, and may be very offensive, with pus and blood mixed in different proportions. Sometimes the blood is so intimately mixed that the whole stool is of a dark brownish colour.

Speaking generally, dysenteric stools are marked by their offensive odour, especially when there is any sloughing process going on in the bowel.

Method of washing Dysenteric Stools.—The examination of the stool in dysentery is of equal, if not greater, importance to that of the examination of the sputum in phthisis, for although in some cases simple inspection of the excreta is sufficient, yet in the great majority of cases, as Macleod points out, the pathological products are mixed up with the feculence in such a way as to conceal them and render it necessary for them to be separated. For this purpose the process of washing dysenteric stools, habitually employed and first introduced by Professor E. Goodeve, at the Calcutta General Hospital, is an excellent one, and is carried out as follows: The stool is received into a vessel of considerable size—*e.g.* the pan of a commode. This is then filled with water poured into it from the height of a foot from a jug or tap. Any masses are then broken up by a glass rod or stick. You allow the material to settle for a few minutes, and then slowly decant the fluid into another vessel, so as to present to view a thin layer. The feculence floats and passes over with the fluid; the pathological products and heavy particles of the feculence subside. What passes out is noted, and then you wash again and again what has remained behind by adding fresh water and decanting until the material is freed of all offensive stuff, when it is transferred to a white plate for examination. This process is generally necessary for any accurate study of the stools in dysentery.

Now this preparation of the stool for the inspection of the physician is important, as by it he is

enabled to judge of the amount of blood passed, of the stage of the disease, and whether it is tending towards recovery or not.

The Nursing of a case of Dysentery.

Should the signs of dysentery become apparent in a patient, no time should be lost in summoning the doctor. Before the latter arrives it will do no harm to wash out the bowel with an enema of warm water, to a couple of pints of which two teaspoonfuls of boracic acid may be added. The main principles of treatment will be (1) rest, (2) diet, (3) drugs. The latter need not detain us, as they are the especial province of the physician.

1. Rest.

The dysenteric patient must at once be put to bed. Rest must be complete, as by this the movements of the intestine are controlled. The use of the bed-pan is essential. Fomentations should be applied to the abdomen. Professor Maclean, of Netley, used to advocate the use of a water-belt, whilst Cantlie recommends a large thick pad, broad enough to cover the whole front of the abdomen. This pad may be either wet or dry.

2. Diet.

(*a*) *In the acute form* this should be as small in bulk as possible and liquid in character, and consist of milk, with whey or ordinary weak tea. Whey is made by taking half a pint of fresh milk heated lukewarm (115° F.); add one teaspoonful of Fairchild's essence of pepsin, and stir just enough to mix. When this is firmly coagulated, beat up the curd with a fork until it is finely divided, and then strain. Lemon-juice or sherry may be added to flavour it. If the thirst is severe the patient can suck small pieces of ice. Where milk cannot be

taken by the patient strong beef-essence is indicated. If he be very weak give him some form of alcohol. As the condition improves rice cooked in milk or broth or gruel of tapioca may be given, and so gradually the diet increased. Solid food must not be taken till some days have elapsed after the disease has abated. All the food must be given in small quantities at a time, and none of it should be taken hot. I remember the very sad case of a brother officer not long after my arrival in India. He had successfully passed through an acute attack of the disease and was nearly convalescent. He was staying in the house of a mutual friend, who left him alone for a few hours. The patient, whose appetite was now somewhat urgent, took advantage of his friend's absence, and left the house to purchase some food. Unfortunately he chose a tin of herrings, which he devoured. Two days afterwards he had succumbed to an attack of gangrenous dysentery.

For natives Buchanan recommends milk (fresh or curdled), rice-water, sago or arrowroot, or "mar" or "dahi" (eight ounces three times a day). "Mar" is made by boiling one pound of fine cleaned rice with three pints of water, and straining—a white starchy substance of the consistence of porridge—will result. "Dahi" is "tyre" made from milk. The two are mixed together and eaten at 10 A.M., 5 P.M., and 7 P.M.

(*b*) *In chronic dysentery* the diet must be more liberal, as the patients are weak and anæmic; but at the same time it must be simple and easy of digestion. Tender chicken, pounded meat, strong soups are indicated, with toast well soaked in cocoa. Egg-flip is also excellent.

PREVENTION OF THE DISEASE.

(*a*) As regards the immediate prevention of the disease from infection by the patient, the nurse

should thoroughly disinfect the stools before they are disposed of, either by means of one of the disinfectants mentioned in a previous chapter, or by boiling, or, lastly, by burning them. The addition of petroleum, as recommended by the late Professor De Chaumont, is an excellent plan if this last method be carried out. In the case of dysentery arising amongst a large body of individuals as well as in isolated cases, the exereta must be protected from flies. This can be effected by pouring chloride of lime on them, as it forms a protecting layer, and its odour keeps off the flies. Keating's powder dusted over the walls of the room into whieh the motions are removed for treatment before burial has also been found efficaeious in keeping off flies. The bedding must be also disinfected after use.

(*b*) *The precautions to be taken by the nurse herself* eonsist in her being careful as regards her diet. All indigestible artieles of food must be avoided and her water should be filtered. As regards her dress, she should always wear her cholera belt, and she should never allow herself, if possible, to become chilled. Cotton should not be worn next the skin, but light merino. Various prophylaetic drugs have been recommended, but the evidence in their favour is not striking; thus, in the Freneh Tonquin Expedition, bismuth was given to the troops. In the China War of 1860 and in the Malay Expedition of 1875-76 quinine was administered. Lastly, sulphuric acid has been recommended with a view of destroying the mieroorganisms. If any are taken, bismuth is certainly not advisable, as this would tend to eonstipation, and constipation predisposes to dysentery.

CHAPTER V.

CHOLERA.

No disease in India has had a more chequered career as regards its etiology than cholera. At the present time, however, luckily for all concerned therein, true ideas are now held upon it. Amongst the names entitled to honour in this respect must ever be enrolled those of the late Surgeon-General M. C. Furnell (of Madras), Surgeon-General Sir A. C. de Renzy (of the Punjab), Professor R. Koch, and Dr. Haffkine.

ETIOLOGY.

In 1884 Professor R. Koch came to India and discovered the Comma bacillus. This organism was at first derided in high places, as its presence, if true, undoubtedly delivered a smashing blow to the views then in vogue. But *magna est veritas et prævalebit.* One of the most valuable testimonies to its validity is given by Dr. Klein, of St. Bartholomew's Hospital, who came out to India to examine into the question on its discovery, and at first denied its efficacy. A few years, however, sufficed to show him that his first opinion was erroneous, for in the last edition of his work on "Micro-organisms and Disease" he acknowledges it to be the prime cause of cholera.

How, then, does this organism cause the disease? The nurse should ever bear this truth in mind, that

the principal way in which it affects mankind is by contaminating the ingesta. A few examples will now be given.

1. *Water Infection.*—India is pre-eminently the land of pilgrimages, and the latter have been the cause of many outbreaks of the disease. To Hurdwar, whence the sacred river Ganges emerges, there is an annual pilgrimage, but every twelfth year is an especially sacred year, and vast numbers of pilgrims there congregate. In 1867 occurred one of the twelfth-year pilgrimages. Amongst the devotees attending it were some pilgrims from the Terai who had cholera. Now during the fair there is one great bathing day (April 12). The bathing-place was a space 650 feet long by 30 feet wide, shut off from the rest of the Ganges Canal by rails. The night before April 12 a heavy storm flooded the camp: the sewage arrangements favoured the washing of the sewage into the Ganges. The requirements of their religion enjoin the pilgrims to bathe in the river and to drink of its water: many also carried home some of the sacred stream to their relatives. Into, therefore, the above narrow enclosure pilgrims from all parts of the encampment crowded, bathed, and drank of the water. The water thus drunk was fouled and contaminated by whatever was washed from the bodies or clothes of the pilgrims. The next day the camp broke up, but not before cholera in an epidemic form had broken out. The dread consequence was that the pilgrims bore the disease with them to a distance varying from 50 to 300 miles to almost every point of the compass.

The Sanitary Commissioner with the Government of India in his report on this outbreak showed how it spread to every point of the compass whither the pilgrims proceeded, how it was not a simultaneous outbreak over a large area, and how no cholera appeared at any station till the pilgrims

arrived thereat. Professor Parkes, of Netley, aptly summed it up "as a gigantic case of water-poisoning."

In 1879 the next twelfth-year festival came round. The same sequence of events again took place. Cholera was brought into the camp, and after the great bathing day broke out in an epidemic form. At this time we were at war with Afghanistan, and here it was that I first saw the disease. "Cholera burst out at Hardwar like a long pent-up fire" and was carried away by the stream of departing pilgrims to our North-West frontier, and thence to Afghanistan. Camp by camp the disease invaded the Khyber, Kurram, and Candahar columns. What was to be done? Now the peace of Gundamuk had been signed, and Government wished to withdraw the troops from the Khyber line, and here their wish was carried into effect on the advice of their Chief Sanitary Commissioner. This officer at that time held the most extraordinary views concerning cholera, against which we had been especially cautioned at Netley by the Professor of Tropical Medicine, Surgeon-General W. C. Maclean—incomparably the most eloquent exponent of tropical medicine that I have ever met—namely, that the propagation of cholera was not due to human intercourse, but to "climate and other causes"! Now at the period we are considering most of the troops were encamped on spurs above the plain, and in perfect health. By remaining here it was held by the sanitary authority that they would become exposed to the "atmospheric wave," whereas by returning to India they would march away from it. By remaining it was held that they would be attacked in greater numbers. This withdrawal, therefore, was ordered and took place; they met the disease advancing from India, and the result was what was termed

"the march of death." Notwithstanding the terrible mortality that ensued, the complacent authorities at Simla held that "the choice was a choice of evils, and, great as the loss was, there seemed every reason to believe that it would have been equally great, perhaps greater, had the troops remained where they were." But the incidence of the disease in the other two columns did not support this opinion. Here, luckily for them, these columns did not march away from the "atmospheric wave." In the Kurram Valley, where I was serving, the troops moved out on to the surrounding spurs in most instances, and the incidence of the disease was far less.

An instance of the propagation by water has been given by Surgeon-General Furnell. In his address at the annual meeting of the Madras Branch of the British Medical Association, held in January 1886, Surgeon-General Furnell showed how, for many years prior to the introduction of the Red Hill water supply into Madras, the number of deaths amounted to hundreds and even thousands; but from the year 1872, when this new water supply was first opened, the reduction of mortality had been enormous. In 1872 the deaths were five only; in 1873, six only; in 1874, *nil*; in 1880, two only. During 1875, 1876, and 1877 this reduction was interrupted. But these three years were years of famine, in which people from the neighbouring districts flocked into Madras, "many of them simply to lie down and die," and almost every death was perfunctorily registered as cholera; or, to use Dr. Furnell's words, "to save trouble were registered as cholera." Again, from 1881 to 1884, the deaths again rose, but during these years there raged one of the severest epidemics of cholera on record in Madras; yet, contrasted with the former huge mortality, the deaths were comparatively few. But mark, Dr. Furnell found on careful inquiry

that *these deaths came from outlying districts where the Red Hill water was not laid on.*

Another example may be quoted from Sir A. C. C. de Renzy's large experience. It is the following: This officer has pointed out, in one of the most convincing chapters on cholera with which I am acquainted, how from the very commencement of emigration, *via* the Brahmaputra (and therefore in strict relation to our present subject), the coolies suffered from "such disastrous epidemics" of cholera that in 1870 the Government of India "was forced" to investigate the matter, and provisions were made for the cubical space on board the steamers, the ventilation and cleanliness of the vessels, food, clothing, water supply, etc. The voyage up the Brahmaputra lasted seventeen days, and during the trip the coolies were inspected by three resident medical officers at intermediate stations. Still the epidemics continued till Dr. de Renzy took up the reins of sanitation in 1877. Turning his attention to the water supply, he was asssured that it, like Cæsar's wife, was above suspicion. The coolies were said to be supplied with water pumped from the great river—and only so pumped in mid-stream—and then stored in iron tanks. He also found that the native crews who used this water were free from cholera, whilst, further, European passengers—and therefore susceptible predisposed material—who used this water were also free from cholera. Hence, here evidently was a crucial proof that it was not the water causing cholera, but indeed certain mysterious climatic, telluric, atmospheric, and meteorological causes, entirely beyond human control. However, Dr. De Renzy, one morning during the progress of an epidemic, got up early, just as the coolies were rising. Two tubs half full of water were placed close to the entrance of their latrines for ablution after defæcation; and *he saw the coolies rinsing their mouths*

with this water, and taking it away in their drinking vessels. On inquiry he found that there being but one tap to their water tank, they could not supply themselves sufficiently from this tank, and *so they were in the habit of drinking from the tubs*, which tubs *were for ablution after defœcation;* if once, then, the latter were contaminated with the excreta of a coolie seized with cholera, or with the preliminary diarrhœa, a splendid "culture" for the virus was furnished. Dr. De Renzy had this state of things at once rectified; the "culture" tubs were abolished altogether; a pump was let into the side of the vessel, and water pumped from the middle of the stream into a long closed cistern provided with a number of taps, whilst water for ablution was separately supplied from the river. *The cholera mortality at once fell, and has never since reached its former figure*; and the result has been that the coolies have been placed in the position of the native crews as regards their drinking water.

Finally, to show the influence of drinking water in conveying the infection, let me quote a crucial instance that occurred in the last station in India in which I served. The striking facts in connection with the well-known outbreak in the neighbourhood of the Broad Street pump in London are well known; but I venture to think the instance to be now narrated is an equally striking one. Dehra Doon Cantonment lies at the foot of the Himalayas, being only distant about four hours from Mussooree, one of the hill stations. It is situated in a lovely valley, and to be stationed there is truly to be stationed in delightful surroundings. The 2nd (King Edward's Own) Goorkha Rifles have been located there since their foundation. Now in 1887 the water supply was taken from the Tons stream, above the source of which were Mussooree, Jharipani, and the hill slopes below them. All the

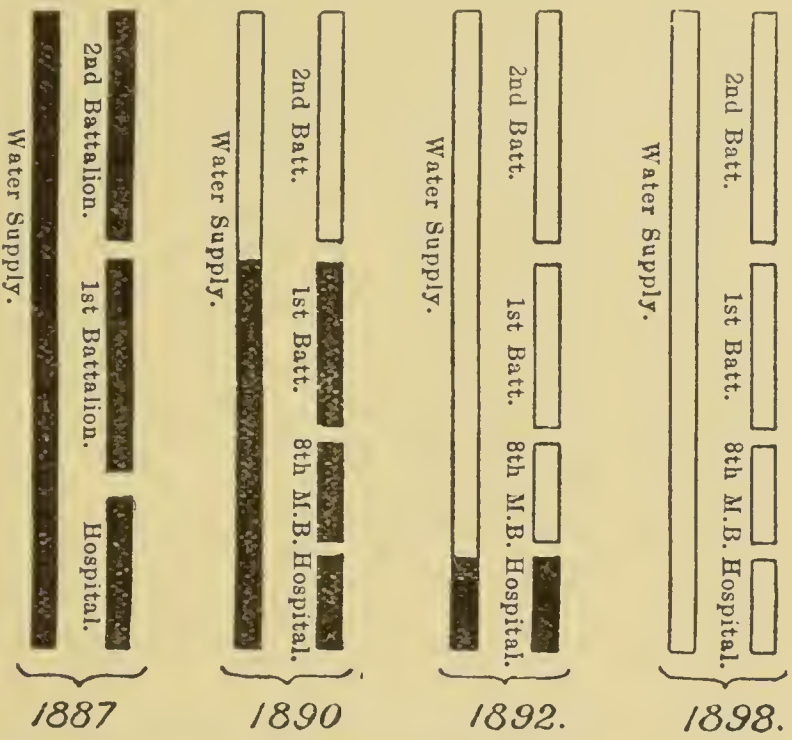
accumulated filth of the slopes was washed into the Tons when the first heavy downpour of rain took place. Numerous filthy villages lie on the banks of the Tons, and also many villages on the canal, from which the water supply of the regiment was taken. The latter is thus barracked. Nearer the hills is the 2nd battalion, of which I was the medical officer; then came the 1st battalion, and lastly the hospital. In 1887 cholera was present in the villages of the district. The first heavy rainfall took place on June 28th, and cholera seized both battalions in an epidemic form on July 1st.

The water supply being so bad, it was decided to institute a fresh one. A natural spring was discovered at the foot of a cliff. Here a reservoir was constructed, from which the water was conducted by pipes to the cantonment. There were no villages lying above the spot whence the water supply was taken off. In 1890 cholera was again prevalent in the district. The 2nd battalion at this date had been supplied with the new water supply; the old still furnished the water to the 1st battalion, the hospital, and to No. 8 Mountain Battery, which had now been stationed in Dehra Doon. The first heavy rain occurred on June 29th. Cholera broke out epidemically on July 2nd in the 1st battalion, the Mountain Battery, and the hospital. No cases occurred in the 2nd battalion, except amongst the men in hospital.

In 1892 cholera again broke out in the Doon consequent on the return of the pilgrims from Hurdwar, not a great distance off. But by this time the new water supply had been extended to the lines of the 1st battalion, and of the Mountain Battery, but not to the hospital. The epidemic was said to have been the worst ever known in the district. This time, however, there was no epidemic in the regimental battalions or battery, but cases occurred in the hospital.

In 1898 once more the disease ravaged the valley of the Doon, but by this time the improved water supply was distributed to the whole of the cantonment, with the result that whilst the disease was ravaging all around, it remained free.

This remarkable example of the good effect produced by a pure water supply may be exhibited graphically by the subjoined diagrams.



The shaded figures show the old water and the extent of the cholera.

The unshaded figures show the new water and the freedom from cholera.

2. *Infection by Milk.* Dr. J. Simpson when Medical Officer of Health reported a good instance of infection through the milk. He investigated a limited outbreak of the disease on board the s.s. *Ardenclutha*. Only one man who drank from a certain milk supply escaped. The native who sup-

plied the milk admitted having added water to it. Now the water was added to it from the tank around which the native houses of the "Basti" stood in Calcutta, the epidemic home of cholera. Several of his neighbours had cholera, and their dejecta drained into the tank. The first case of cholera occurred amongst the milkman's neighbours on March 7th. The first case of the disease occurred on the *Ardenclutha* two days later.

3. *Infected Solid Food.*—Numerous examples of infection carried this way have been recorded by Hankin and others. Dr. Clark, the Civil Surgeon of the hill station Dharmsala, was infected with his son and his khitmagar's wife, there being no cholera at the time in the station, though in the district. Three days previously some strawberries had been sent to him from a station some twenty miles off in the infected Kangra valley, and the coolie bringing them had sprinkled them with water on the way. Cholera at the time was present in the valley. The only members of Dr. Clark's own family who partook of the fruit were himself and his son.

Dr. Fairweather reported a most instructive example of the manner in which the infection is carried by food. In 1871 there was very little cholera in the Punjab, but a sudden outbreak occurred in Delhi on November 28. On inquiry it was found that a man had died of cholera, whose discharges had flowed on to the earthen floor of the room in which he died. This death occurred on November 20. The floor is said to have been cleaned with cow-dung. On November 26 a burial feast was held; the food for the feast was cooked in this room, and the moist hot rice spread on a mat on the floor. The dead man belonged to the "Reghar" caste; almost all the males of this caste attended, in number about 350. Besides the Reghars, a few outsiders also came. The feast took place on midday, November 26; a few hours after

cholera broke out in those who had attended it. Forty-seven cases occurred by November 29, and by December 4 these had increased to seventy-three. The disease did not spread from this centre. Now locality could not explain the outbreak, for mixed up with the Reghars were the Chamars. No Chamar, however, attended the feast, and no Chamar was attacked. As we have seen, also, a few men of other castes attended, living in the same neighbourhood; those who attended suffered like the Reghars, but those who were not invited entirely escaped. It was entirely limited to those men who attended the feast, and to the wives of those Reghars who had brought home with them portions of the feast. Can, therefore, asks Professor Parkes, any experiment be more complete to prove that it was the food—masses of rice heaped up on the floor which had been covered with choleraic discharges—that caused the outbreak?

One more example may be quoted reported by Hankin. This distinguished savant investigated the details of an outbreak at the officers' mess at Saugor in 1896. Here out of thirteen dining, nine were seized either with cholera or diarrhœa. The cooking and drinking water had been passed through a Pasteur filter, and so was free from infection. Hankin discovered that all of those infected had partaken of a certain chocolate pudding, and in searching about for the means whereby this pudding became infected, he suspected a dish-cloth in which the vessel containing water had been carried. It was then found that this dish-cloth had been washed in a stream into which the excreta of some cases of cholera had passed. The vessel for the water of the kitchen was wrapped in the dish-cloth; during its conveyance to the kitchen water from the vessel had evidently splashed into the cloth: the chocolate-pudding during its preparation was wrapped in this cloth: the cholera organisms

found a ready medium for growth in the gelatin of the pudding, and thus those eating it became infected.

4. *Infection by means of clothes.*—Hankin relates the following instance. In 1889 cholera was very bad at Bussorah, so much so that many people left in terror of the disease. On a certain day a fisherman found a bundle of clothing lying on the road on his way from that place to his boat, which he took up and carried with him. He then started on his journey to his village of Bariki, 50 miles off. Four days later he arrived at the end of his journey. As the clothes were female apparel, he gave them to his womenfolk, who divided them amongst themselves. Four days later all had died of cholera. Neither the fisherman himself nor anyone else in the village was ill.

5. *Infection by Flies.*—As before remarked, with reference to enteric fever, the common fly is probably the most noxious insect on the face of the globe. Its harmfulness is equally apparent with regard to cholera. Colonel Macrae, I.M.S., when in charge of the Gya Gaol, with reference to the outbreak of cholera there states that the first case occurred in the person of a newly admitted prisoner, who appears to have contracted the disease on his way to the gaol. The man occupied successively several wards, and passed evacuations which were not specially dealt with in any way. There were swarms of flies in the gaol that had easy access to excreta, food, and milk. The water was beyond suspicion. It was thought that the flies had probably carried the infection from the dejecta to the food. To test this view, little pots containing freshly boiled milk were placed in various spots in the gaol. On being subsequently examined, some of the pots contained flies that had drowned themselves in the milk, and in these pots the cholera microbe was discovered. Such are some of the ways

in which the liquid and solid elements of the food are contaminated in the tropics.

An example may be mentioned showing how an epidemic can arise on apparently inexplicable causes. Mr. Hankin was taking an early morning walk in a certain station, and passed a coolie, carrying milk to the British barracks, filling up his cans with water from a dirty roadside pool. He was at once reported, and the milk thrown away. Now, supposing the pool had been infected, and supposing the coolie had not been seen by Mr. Hankin, a number of cases of cholera might have arisen. The milk supplied to cantonments is supposed to be pure: in such a case it would have been held that the cholera arose from "climate and other causes." Lastly, to show that the spirillum of Koch is the cause of cholera, an instructive example was afforded from Berlin. In Koch's laboratory in that city there are throughout the year courses on bacteriology. During a certain course there was no cholera at the time in Berlin, but one of the medical men, during the investigation of the cholera organism, neglected the necessary precautions, and consequently was infected by it; he was seized with the disease, and showed the typical intestinal discharges, almost complete suppression of urine, and pains in the limbs, whilst large quantities of cholera spirilla were found in his fæces.

Symptoms of Cholera.

In a typical case, after a period of incubation of one to three days, the symptoms of invasion show themselves either by a sense of malaise, or by a premonitory diarrhœa. This period is all-important to recognise in any epidemic, as before the disease is fully developed the physician has some hope of arresting it. Or the onset may be sudden, characterised by an immediate uncontrollable evacuation of a large loose stool; this is followed by a con-

tinuous or intermittent flow of fluid, at first bile stained, then thin and watery with no fæcal look or smell, and containing whitish flocculi—the so-called rice-water stool. Next occurs vomiting, first of the ordinary contents of the stomach, then of a fluid like that from the intestines. Then the patient is harassed with the most distressing cramps. And finally the stage of collapse sets in: here the tissues shrink, the eyes fall back into their sockets, the skin becomes blue, the tongue looks like a piece of lead, the respirations are shallow and rapid, the voice is reduced to a whisper, the pulse is thready and scarcely perceptible, the temperature falls, the skin becomes covered with a cold sweat, and the breath is cold. The axillary temperature falls, it may be to 92°; whilst that in the rectum is high—101° or 102°. There is suppression of bile and urine, but not of milk in nursing women. Although apparently moribund, yet the patient can get up and walk across the room.

This stage lasts for about two hours, and terminates either in death, secondary fever, or convalescence. Especially as regards prognosis is to be noted the re-establishment of the secretion of urine and the appearance of bile in the motions.

Such would be the clinical features of a case of cholera in its entirety: during an epidemic, however, the clinical picture often varies. Thus we may find no suppression of urine, but the diarrhœa may be very pronounced, copious, and watery; or death may occur most rapidly without any vomiting, diarrhœa, or cramps. The stage of collapse again may be very short or very prolonged.

TREATMENT OF A CASE OF CHOLERA.

First, we may mention the means of prophylaxis to be recommended in cholera times, both to the nurse and also to those exposed to infection.

During cholera time everyone, including the nurse in attendance, should bear in mind the following facts: The chief point to remember is to keep one's digestion in order, for Professor Hay showed some years ago by experiment that the cholera microbe can pass through the stomach when the reaction is alkaline, but is killed by an acid one. Therefore it is well to take twice daily a "ration" of dilute acetic acid or hydrochloric or sulphuric acid, or else sulphuric acid lemonade made by adding fifteen drops of sulphuric acid to each bottle of lemonade. Dr. Craig recommends as a certain prophylactic oranges or lemons. Botkin, at St. Petersburg in 1871, found quinine useful for this purpose. Sulphurous acid in drachm doses has also been given with good effect. The food must be simple, and not calculated to upset the stomach. Alcohol should not be taken, as it is likely to derange the stomach; neither should damp bread nor unripe fruit be eaten. All water used for drinking must be boiled. Of the efficacy of boiling Hankin gives a striking instance as follows: He once had to examine a serious outbreak of cholera in a British regiment. All the men had the same supplies of water and of food, but one of the companies remained free from the disease. The reason of this no one knew, until at last it was discovered that the officer of this company had had all the water drunk by the men boiled. Hankin has also shown that the cholera organism is killed by carbonic acid gas in aerated waters, provided that no bicarbonate of soda has been added. Three hours, however, must elapse between the bottling and the bringing of the aerated water into use. Red wines are excellent to drink, owing to their containing tannin. The best filters are, as stated in the lecture on enteric fever, the Pasteur or the Berkefeld. An instructive example of the effect of want of care in filtration was afforded a few years ago by the East Lanca-

shire regiment. Here the disease was actually propagated through the agency of the ordinary barrack-room filter. The sand used in the filter was taken from the Mobi Ghat on the Gumti river. When the company first affected moved out into camp this filter was passed on to another company, which was at once stricken with the disease; and, on examination, the sand in the filter was found teeming with cholera organisms.

Again, look at the history of the terrible epidemic of cholera in Hamburg in 1892-93. Hamburg, Altona, and Wandsbeck immediately adjoin one another, forming one city, and differ only in their water supply. Wandsbeck receives water from a lake scarcely exposed to infection from fæces, Altona gets its water filtered from the Elbe below the city, whilst Hamburg gets unfiltered water from the Elbe at a point above the city. In this epidemic Wandsbeck and Altona suffered scarcely at all, whereas Hamburg was terribly affected.

Such, then, are the more general precautions to be taken. We now come to the method of preventive inoculation, introduced by Professor Haffkine. The latter found that his vaccine protected animals with certainty and in an absolutely safe manner against all forms of cholera virus fatal to them. He then tried it on man. Like all great discoveries, it met at first with opposition, but few in India doubt its efficacy now. So much is this the case that in the latest Sanitary Report for Bombay the efficacy is evidently taken for granted, for, for the first time, no mention is made of the results.

The inoculation is carried out in two stages, separated by a few days' interval. The first inoculation induces a feeling of malaise, passing off in twenty-four hours. The second one causes a severer feeling of discomfort, but only for twenty-four hours; at least, such was the course in my own case and in those of my brother officers of the

1st Goorkhas, in which I was then officiating as medical officer, who, with the majority of the men, were all inoculated by M. Haffkine. I would strongly advise every nurse to be inoculated for cholera. There is absolutely no danger in the process. The period of immunity thus gained is not yet determined, but is at the present time stated to be two years at least. Space forbids me to give many examples of the good effects exerted by this procedure. We may, however, cite the cases of Calcutta, Gaya, Cawnpore, and Lucknow. Here 2,235 cases were observed, of which 500 were inoculated, with 21 attacks and 19 deaths, giving a percentage of cases to total number of 4.2, and of death 3.8. The uninoculated had 174 attacks with 113 deaths, or a percentage of cases to total number of 10.63 (contrasted with 4.2), and of deaths of 6.51 (contrasted with 3.8). Professor W. J. Simpson again reported on the results of two years' anti-choleraic vaccination in Calcutta, and showed, amongst other facts, that in 77 houses there were 89 deaths from cholera, of which 77 were among the uninoculated, and only 12 among the inoculated. The evidence in favour of the beneficial results obtained from inoculation is indeed overwhelming.

Such are some of the prophylactic means at our disposal. It is only necessary to add that the cummerbund should be always worn, and that the mind should be kept in a cheerful condition. Lastly, the nurse should never eat her food in the patient's room.

It may be useful to add to the above statements that some observers have laid stress on the fact that certain symptoms in individuals point to the probability that they may be attacked. Hence, should these symptoms appear, all the precautions as to regularity of life and avoidance of any hurtful article of diet should be especially carried out. Poynanski has stated that during the prevalence of

cholera the pulse in all those naturally predisposed to take the disease becomes extremely low—45 or 42—even when they are apparently in good health, and that this lowering in cholera times may occur weeks before the onset, and may be considered as pathognomic of the disease. As the result of his researches, he states that cholera attacked only those who had previously exhibited this pulse diminution of frequency. Annesley also states that the countenance of a person at the very earliest stage is often pallid, anxious, and sorrowful. It may be well to remember these facts, so that those persons exhibiting these symptoms may be warned to be especially careful as regards their diet, wearing their cummerbunds, etc.

SUMMARY OF RULES TO BE OBSERVED IN TIMES OF CHOLERA PREVALENCE.

1. Keep cheerful, and have your time occupied in some work.
2. Wear your cummerbund.
3. Be attentive as regards the food you eat. Let there be nothing indigestible.
4. Avoid all spirituous drinks. If any stimulant is necessary, take red wines.
5. Aerated waters, oranges, and lemons are all excellent.
6. Always filter your water with the Pasteur or Berkefeld filter, or else boil it and add a few drops of Condy's fluid to it.
7. Take a daily "ration" of either hydrochloric, sulphuric, or acetic acid, or else drink sulphuric acid lemonade.
8. Never eat your food in the patient's room.
9. Be inoculated.

Before proceeding to the measures to be followed out in the actual treatment of a case, it may be of

advantage to narrate a means of preventing or of arresting an outbreak in a given community. This method, of course, will ordinarily be put into action by the medical officer in charge, but it might happen that a nurse were by herself in some out-of-the-way district in India where cholera arose, and she should then advise the following proceeding as regards the wells of the place in which she happened to be.

We are indebted to this efficacious preservative to the genius of Mr. Hankin, the bacteriologist to the Government of the United Provinces of India. Permanganate of potassium will destroy the pabulum necessary for the reproduction of microbes, and he accordingly concluded that by adding this substance to the wells he could prevent at once the latter becoming a source of the propagation of cholera. He experimented on a number of wells at the village of Shahgunj, near Agra. In half of the number so treated the microbes vanished in two to three days; in the remaining half, not treated with permanganate, they remained at least a week in the water.

Two ounces of permanganate of potash in the solid state should be put into the bucket of the well, the bucket then lowered and drawn up filled with the water. Then stir it up thoroughly, and pour the resulting red solution into the well, leaving the portion not yet dissolved at the bottom of the bucket. Again lower the latter, and repeat the process till all be dissolved, lowering, drawing up, and emptying the bucket for this purpose. After all has been dissolved let half an hour elapse, and then draw up some of the water. If a red colour be still present, enough has been added; if there be no red colour, more permanganate of potash must be added. In all cases a faint red colour should remain for twenty-four hours. The substance should be added at night, so as to leave the water undisturbed as long as possible.

As regards the quantity of permanganate to be added, for most wells 2 to 3 oz. will be sufficient; if the well be very foul, then 8 oz. may be required. In cantonments, Hankin also adds after the permanganate of potash an equal quantity of hydrochloric acid; this will increase the activity of the permanganate.

All vessels in the houses of the village should be washed with the solution.

As showing the good results obtained from this process, we may mention the evidence of Surgeon-Major Pratt, of the Indian Medical Service. He has recorded the case of fourteen villages, half of which had the wells so treated, and half not. They were all in the same district, that of Gonda, and all were experimented on during the same epidemic in 1895. The population in the two divisions was about equal. Now the results obtained were the following: Among a population of 4,714 in the villages with the wells untreated, there were 123 cases of cholera, and the outbreaks had an average duration of $22\frac{1}{4}$ days; with a population of 4,601 in the villages with the wells thus treated, there were 56 cases of cholera, with an average duration of the outbreaks of $14\frac{1}{2}$ days. Again, Mr. Palmer, a superintendent engineer to the United Provinces, from his experience of this method, bears witness to the good effects produced by it. The permanganate of potash should be supplied made up in 2 oz. packets for convenience. At one time chloride of lime was also used for a like purpose, but this has now been given up.

We may now say a few words on the medicinal treatment of the disease that the nurse, in our opinion, should bear in mind, if called upon to suggest any measure in the absence of the physician. Now in all cases the first endeavour must be to treat diarrhœa. Unless immediate treatment be instituted, this diarrhœa will

rapidly proceed to develop into the fully-developed disease with all its risks. Therefore the question is how is this diarrhœa to be treated? In considering this question it must be borne in mind that the largest amount of mortality occurs at the commencement of any epidemic. Cases will die in a most disheartening manner, whatever plan of medicinal treatment be adopted. The medical man should be at once summoned; but until the doctor arrives something ought to be done. There are two chief schools of practice in this direction. One whose maxim is to stop the diarrhœa, or to try and stop it by giving astringents, such as chlorodyne or laudanum. With this method I have personally no sympathy. When a medical student I had the great advantage of being taught what to do in cholera by the late Sir George Johnson, the Professor of Medicine at King's College. This eminent physician was struck by the mortality that had followed the opium treatment. He was gifted with a mind that refused to follow blindly the precepts handed down to him. His explanation of the phenomena of collapse is the only one with which I am acquainted that explains them thoroughly. Now Sir George Johnson's view of the diarrhœa of cholera was that it was an effort of Nature to expel the poison from the body, and accordingly he taught that this symptom was not to be checked, as by doing so you shut up the poison in the body. On the contrary, he advocated the aiding of the flux from the bowel by giving castor oil, or, where it could not be taken, by pulv. rhei. co. Of course, every physician has his own views on the matter. I can only state that if ever I were seized with cholera I should never dare to take opium, but would have administered to me castor oil. The Royal College of Physicians has also adopted this view, judging from the nature of the prescription it advised on the probability of an outbreak of the

disease a few years ago. During my service in India, whenever I had any cholera to deal with, I always gave castor oil. At the very commencement of it I had a striking instance of its efficacy. At the time I was on service in Afghanistan in the Kurram Valley, when the great outbreak occurred in India after the Hardwar Fair of 1879. The returning pilgrims carried the disease away with them in all directions, and it advanced up the three lines of the invasion of Afghanistan. At that time the 23rd Pioneers, to which I was attached, was encamped in this manner: The headquarter wing was located up the Shank Gorge about 8,000 feet high, employed in cutting down logs, making lime and slates from the rocks of the gorge for the new cantonment that had been ordered to be made in the Kurram Valley after the peace of Gundamuck had been signed The other wing was encamped in the valley below, about three miles from the mouth of the gorge. About twice or three times a week it was my duty to ride down and visit this wing. One day on arriving there I found three men admitted for cholera, whilst twenty-nine were admitted for severe diarrhœa. It was proved afterwards that these men had, contrary to orders, visited the neighbouring village of Shalozan, where the disease had been imported by some of the pilgrims returning to Afghanistan. The above sick were at once given castor oil, the cholera cases removed up the gorge, and isolated below our camp there. On visiting the sick again the next day I found the diarrhœa checked, and subsequently all, both diarrhœal and cholera cases, recovered. During my subsequent career in India I only once gave tincture of opium; but the patient promptly died. This case, of course, proves nothing, but I can honestly say that the mortality of the cases receiving castor oil

seemed to me to be much less than that attending the cases I heard were treated with laudanum.*

THE NURSING OF A CASE OF CHOLERA.

The patients in all cases of diarrhœa setting in in times of cholera must be kept quiet in the recumbent position. They must also be kept warm. This naturally will require no special means in the tropics, but in the instance of a case of cholera occurring in a cold climate, the patient should have hot bottles and blankets. The room must be kept as cool as possible.

As regards the actual treatment of a case of cholera, the late Dr. Norman Chevers, Professor of Medicine, Medical College, Calcutta, wisely observes in his book on the "Diseases of India" that "*all his experience tended to show that few things avail more in the management of cholera than sedulous care and good nursing. Sensible nurses may be readily trained, and need have no apprehension whatever that this duty will, in the very slightest degree, add to the danger which they share with every other member of the community. In giving ice, in seeing that the patient does not incur the peril of sudden death by syncope on having his head raised, in attending to the heat of the water-bottle, and in applying the sinapisms, in keeping to their work the relays of assistants who apply the*

* It should be stated, however, that the evacuant plan of treating the early diarrhœa does not find favour with many writers. For instance, Mr. Macnamara, one of the great Indian authorities, and moreover a pupil at one time of Sir George Johnson, advocates the treatment by laudanum, acetate of lead, and dilute sulphuric acid. I may here mention a very successful plan of treatment recommended by Major Harold Brown, I.M.S. This officer, during a certain epidemic, gave 10 minims of oil of eucalyptus every quarter of an hour at first, then hourly, in a teaspoonful of milk. For children the dose was 1 to 3 minims. The vomiting was stopped at once, and the diarrhœa later. Opium was never administered. The rationale of the treatment was that of destroying the microbe in the intestine.

dry ginger frictions, in feeding, in encouraging the patient, and, indeed, in carrying into effect every means of relief and every needful precaution until convalescence is established, an active and experienced nurse is invaluable." The above extract portrays summarily the main points to be carried in the mind of the nurse as regards her duties towards a choleraic patient.

THE NURSING OF THE PATIENT.

The patient must be kept quiet in the recumbent position, and as warm as possible with blankets and hot-water bottles. The symptoms most distressing to the sick man are the *thirst*, the *vomiting*, and the *cramps*.

The thirst may be allayed by drinking cold water, acidulated by adding lemon-juice or a few drops of dilute sulphuric acid, or the latter may be given as sulphuric acid lemonade, prepared as mentioned previously, or the patient may be given ice to suck. The *vomiting*, if excessive, can be often stayed by counter-irritation, in the shape of mustard poultices to the epigastrium. If the vomiting be associated with the diarrhœa, Sir George Johnson advised that it should be encouraged by copious draughts of tepid water. "*The vomiting affords relief, partly by the stimulus it gives to the circulation, but mainly by the speedy ejection of morbid secretion.* The *cramps* are best mitigated by rubbing the parts with dry ginger or mustard oil, and covering the limbs afterwards with flannel wrung out in hot water, with some mackintosh or oil-silk outside the latter. The attendant must on no account yield to the solicitation of the patient to give him opium for their relief, for they show that the poison which excites them is still circulating in the blood, and they can only be effectually lessened by the escape of this poison. Now an opiate would

hinder the exit of the poison fom the blood. Lastly, should there be *nausea without vomiting*, an emetic may be given, a teaspoonful of mustard, or a tablespoonful of common salt, or 20 grains of ipecacuanha powder in warm water.

It is important to remember that in collapse the patient must be kept strictly recumbent; he must not be raised even to go to stool.

THE DIET OF THE PATIENT.

It is useless to attempt to feed a patient during an attack of cholera collapse or until reaction has set in. The digestive powers are in abeyance, so that even the mildest nourishment increases his distress. You can neither feed the patient by the mouth or by the rectum. Food is at once returned, and with each act of vomiting or defecation thus excited, the patient becomes more exhausted. When, however, reaction has set in, and the normal secretions of the stomach are restored, then give the most easily digestible foods frequently, but in small quantities, such as milk, gruel, arrowroot, chicken broth, soup, or beef-tea. A small addition of brandy may also be administered. About this time the patient may suffer from pain in the epigastrium. This can be relieved by counter-irritation or a few leeches.

But cholera is ever a very fatal disease, and especially at the beginning of an epidemic the efforts of the physician to ward off a fatal result often end in an untoward result. One line of action must, however, be always followed—namely, that of preventing the disease being carried to others. Now the attendant must remember that cholera is infectious by means of the stools acting through the following channels—namely, the food and drink, washing-water, and everything that is *wet*; by mussucks, packals, and dhols; earthen vessels containing milk,

chattis, surahis, clothes, jharans or dish-cloths, flies, etc. Hence the measures to be employed to render such channels innocuous will now be detailed.

My old brother officer, Colonel J. Duke, I.M.S., when P.M.O. of the Punjab Frontier Force, drew up a most excellent code of rules, which included all that is essential in this direction. I cannot do better than incorporate his recommendations with some others. At the outset the nurse should remember that the cholera microbe only lives and reproduces itself in water. Hence, in cholera times everything that is wet should be suspected. The organism can be easily killed by antiseptics or by long exposure to sunlight. It is also rapidly destroyed by boiling for two or three minutes, or by drying, by acids, and by carbonic-acid gas in aerated waters, provided no bicarbonate of soda has been added.

The Stools.—Too great importance cannot be attached to the treatment of the stools. One plan is to receive them into the bed-pan containing a solution of carbolic acid (1 in 20) or of corrosive sublimate (5 per cent. solution). As soon as they are passed add some more of the respective solution, and mix the stool with the latter. But the best plan is to burn them. Professor De Chaumont advocates burning them with petroleum and sawdust.

Food and Drink.—We have already narrated instances how the disease is spread by these agencies, and given direction as to the disinfection of wells. Further measures to be undertaken are amongst the following: The cook-house floors should be daily washed with permanganate of potassium solution; strength, ½ oz. to each bucket of water. Chattis and surahis (earthen vessels made of clay) should be abolished during cholera times; indeed, it is advisable to stop their use altogether. Metallic lotas should be treated with heat, or by filling them with

hot ashes. Lastly, in any cholera case the following articles should be avoided—namely, milk and cream, cold puddings, jelly made from gelatine, in which, being alkaline, the cholera microbe finds a very suitable medium for reproduction, and salads and other uncooked vegetables which might have been wetted with infected water. An instance of this last method of infection occurred some few years ago at one of the hill stations in India, where a sergeant and some men caught the disease from eating infected salad.

Dishes and plates must be washed in boiled water, with the addition of a cupful of dilute sulphuric acid to each bucket.

The Cook and Masalchi.—One of the great difficulties we have to meet in the East is the counteracting the dirtiness of the native servant. But it should be insisted on that, before entering a cookhouse, the native cook and masalchi should be made to wash, and then put on clean clothes or dhoties that have been previously boiled or dried in a hot case. Their other clothing should be left out in the sun. Again, do not forget the fact that native cooks use a piece of muslin for straining sauces, etc. This is never washed, or, if so, may be washed in infected water. It is of little use forbidding its employment, because, if not used, the dirty cook will very likely strain the sauces, etc., through his own loin cloth. Hence, the muslin must be washed daily in permanganate solution.

The kitchen must be kept as dry as possible, and no servant be allowed either to sleep in it or to keep his clothes therein.

In the compound of the bungalow in which the patient is lying the sick attendant will perchance light on damp stagnant mud near puddles. Such damp mud may have been infected in some way or other with the cholera virus, and may then have been used by the servants to scrub their lotas with.

In this way the infection will be carried to the food. This damp mud and the puddles should be covered with clean, dry earth, and carbolic acid poured on them. Carbolic powder should be supplied to the latrines; its smell will discharge the assemblage of flies.

Mattresses, Blankets, and Clothing. — The microbe is easily destroyed by drying. Koch states that simple drying in the open air is sufficient to disinfect them. Hence they should be exposed to the sunlight in the open air for twenty-four hours before washing.

Dusters and dish-cloths should be well dried every day in a hot case. The best plan, however, is to burn all these infected articles. If not, to boil them for an hour, or soak them for two hours in corrosive sublimate solution (4 oz. to 1 gallon of water), or for twenty-four hours in carbolic acid and chloride of lime solution (carbolic acid, 2 per cent.; lime, 1 per cent. solution).

Flies.—Especial care must be taken to protect all articles of food from flies by the usual perforated covers. They should be excluded from the house by wire-netting over the doors and windows.

The Sick Apartment.—The walls and floors should be brushed over with carbolic-acid solution (1 in 20). Should the patient have been treated in a tent, the latter must be fumigated. Five drachms of sulphur are to be used for every cubic yard of space, and the tent then fumigated, the flaps being closed for three hours. After which it remains exposed to the air for ten days. Another method of fumigation is by means of nitrous acid. To do this you use copper shaving, $\frac{1}{2}$ oz.; nitrous acid, $1\frac{1}{2}$ oz.; and water, $1\frac{1}{2}$ oz.

The bodies of the dead should be burnt, or buried enveloped in a sheet saturated with corrosive sublimate or carbolic acid and chloride of lime.

In concluding these remarks on cholera, a word

of warning may be uttered to the nurses and attendants on the case. Formerly one of the stock arguments in favour of the ridiculous climatic theory of cholera and against the disease being propagated by human intercourse was the fact that nurses were not especially attacked. Doubtless they are not more liable to be seized with cholera than any other member of the community. But this depends entirely on their being scrupulously punctilious in the various matters to which I have drawn attention. Should the precaution as to their food or as to their personal care be neglected they will lay themselves open to infection. Cholera is not a disease caught like scarlet fever or typhus; it is caught only through the infective matter from the stools getting by some medium or other into their bodies. In many epidemics the attendants on the sick have suffered greatly. To mention only a few: In the epidemic in Egypt in 1883 Surgeon-General Irvine reported that the men of the Army Hospital Corps suffered out of all proportion to the men of the other branches of the Service. Again, Griesinger's statistics for Moscow for 1830 showed the mortality amongst the hospital attendants was 30 to 40 per cent., whilst in the general population it was only 3 per cent. In 1849 Laveran, in Toulon, showed that the hospital attendants died at the rate of 1 in 3, whilst in the garrison the mortality was 1 in 15. In Oran in 1865 the hospital staff mortality was 8 per 1,000; that of the garrison was 1.66 per 1,000. Lastly, in Toulon and Marseilles, in 1865, the respective rates of mortality were as follows:—

22nd Regiment	...	...	31.75 per 1,000
28th Regiment	...	...	29.8 per 1,000
38th Regiment	...	...	19.33 per 1,000
Hospital attendants	...	...	*38.60 per 1,000*

CHAPTER VI.

MALARIA.

No disease has been such an enemy to the human race as malaria, and manifold have been the theories concerning it. Major Ross states that the mortality from fevers is said to be at the rate of 10,000 a day, and of these fevers the larger proportion include malarial fevers. Malaria is responsible for the stoppage of civilisation in many regions of the earth, and we fully agree with Ross when he states the name of the "dark" continent of Africa should rather be that of the "Malarial" continent. To give some idea of the havoc this affection causes we find that, according to the Sanitary Commissioner's Report for the Government of India for 1900, there were 5,000,000 deaths from "fever," most of which were malarial. More exact reports are those of the Army and Gaol returns, as these were attested by medical men. Here, among 305,927 people, there were 102,640 admissions for malaria, whilst many other cases were not included in these returns, as many slight forms were not admitted. In Italy, Celli states the annual number equalled 2,000,000, with a yearly mortality of 15,000. In Africa, Koch says 50 to 100 per cent. of the negro children are affected.

ETIOLOGY.

What is the cause of this terrible disease? Many have been the theories upheld to account for it. Its

name "malaria" indicates that it was first thought to be due to the inhalation of "bad air." An exhalation from the marshes was widely held to be the cause. Then we had the theory of "chill." Professor Maclean of Netley wisely criticised this latter theory when he showed how in Madras, in a certain locality in 1869-70, out of a total population of less than a million and a half, over a million suffered from malaria, "a terrible consequence to have resulted from a chill."

The two names that stand out pre-eminent in the discovery of the cause of malaria for all time are those of Laveran and Major Ronald Ross. In the year 1880 Dr. Laveran discovered the presence of minute parasites that live within the red blood corpuscles of the patients. This was the first step in the elucidation of the true pathology of the disease. The next question to be determined was: How did the parasite, an organism belonging to the protozoa, reach the patients. Was it exhaled from the marshes or from the surface of any earth disturbed by digging, or did it enter the system by the drinking water? In the year 1889 Major Ronald Ross, of the Indian Medical Service, began to work at the subject in India, but at first without obtaining any results. In 1894 he returned on furlough to England and saw Manson, who imparted to him his great hypothesis that the mosquito was the intermediary host, a view that had also been held by Laveran, King, and Koch, for in 1883 King had suggested that the malarial poison was carried from marshes to human beings by the mosquito—a view propounded also by Laveran in 1884 and by Koch in 1883-84. Ross, on his return to India, immediately began to work on the lines of this theory, and for many long years laboriously applied himself to the verification of this idea. Only those who have worked in India can form any idea of the exhausting nature of this work. Ross tells us how he

was forced to labour in the oppressive heat without the alleviating aid of the punkah, for fear the latter should disturb him in the preparation of his slides. But his indomitable energy at length enabled him to solve the problem and to add thus additional renown to the service of which he was a member.

Up to the year 1897 he had dissected and examined literally hundreds of mosquitoes without any result, as unfortunately he had been investigating the wrong species of this insect. In this year, however, fortune at length favoured him, for he now searched a different variety of the mosquito, and at last his labours were crowned with success. Briefly stated, the following is the sequence of events established by him:

The parasite producing malarial fever is an organism belonging to the protozoa called the *hæmamœba*. This organism spreads the disease from one man to another. How? King, Laveran, Koch, and especially Manson surmised that the mosquito carried the disease, a supposition proved to the hilt by Major Ronald Ross, who, after long and laborious investigation, demonstrated that the parasites of malaria found by Laveran passed a hitherto undiscovered stage of their existence in mosquitoes, and are then inoculated into the skin of man by the bites of these insects. When a mosquito, Ross tells us, bites a malaria patient it sucks up a number of malaria parasites with the patient's blood. These parasites then burrow into the mosquito's tissues, grow rapidly, and after a week or two produce a number of spores. The latter then enter the poison or salivary gland of the insect. This gland secretes a minute drop of fluid, which the insect injects through its proboscis into the skin of man when it bites him, and to which the itching caused by the bite is due. The spores of the parasite lie in this fluid, and are injected with it into the skin, where they mix with the blood and cause infection. Such,

briefly, is the cycle of events discovered after years of patient and exhausting labour by Ross, a discovery which is fraught with the greatest benefit to mankind; the benefits resulting from it can indeed be compared only with those consequent on the discovery of vaccination by Jenner, of the antiseptic treatment of wounds by Lord Lister, and of inoculation for hydrophobia by Pasteur, for the deaths averted by the labours of these four savants are, indeed, truly comparable.

Proof of the Truth of the Mosquito Theory of Malaria.—This has been shown both from the negative and the positive side. From the *negative* side, by Drs. Sambon and Low, who in 1900 lived with two servants in a mosquito-proof hut near Ostia, in the Roman Campagna, a spot known to be intensely malarial. They remained in perfect health, although their neighbours, not taking the necessary precautions to protect themselves from malaria, suffered as in former years. Thus the negative proof showed where there were no malaria-bearing mosquitoes there was no fever. From the *positive* side it has again been proved, for Manson procured from Italy some mosquitoes that had fed on a patient suffering from tertian ague: his son was bitten in England by them and became infected with tertian ague. The laboratory assistant at the London School of Tropical Medicine, during his manipulation with these insects, was also bitten, and also had an attack of malarial fever. One more proof was afforded by Bignami in Italy, who caused a man, who had also never been exposed to the chances of malarial infection, to be bitten by infected mosquitoes, and in consequence incurred an attack of the disease. Thus given the bite of a malarially-infected mosquito, an attack of malarial fever will follow.

Before proceeding to the symptoms and treatment of malaria, let us consider shortly how the mosquito

theory explains some of the facts in the etiology of malaria.

1. *Effect of Turning up the Soil.*—Malaria often develops in previously healthy districts consequent on the digging of canals, foundations for houses, etc. For instance, Nuttall tells us of the severe outbreak of the disease that was associated with the excavation of the Panama Canal. This sequence of events is explained by the formation of pools of water in the excavated land, acting as nurseries for the mosquito, which become infected by workmen coming from malarious districts.

2. Malaria is most dangerous *after the sun has set.* This is due to the fact that mosquitoes remain for the most part during the day lying low "in woods, weeds, or low underbrush, and come out after sunset and at night to indulge in their blood-sucking propensities."—King.

3. *Sleeping out of doors* is more dangerous than *being awake out of doors*, for, as King observes, a person when awake will brush away the insect, which would bite him if he were asleep. In January 1887 the *Turquoise* was at Kilwa Kisiwani, in East Africa. Three officers and seven sailors camped on shore one night, after having been in search for a lost sailor. The men slept; the officers remained awake. After about ten days all the sailors developed malaria, whilst the officers remained healthy.

4. In malarial districts *the use of fires* is a preventive measure against malaria, for the mosquito is attracted by them, and flies into them, and is so killed. The smoke also would tend, on the other hand, to drive them away.

5. *Racial Immunity.*—There is a relative immunity enjoyed by negroes, due to many causes, such as the protective colouring, the offensive odour emitted by their skin, or by their anointing their

bodies with grease, or from their thicker skin, all of which factors militate against the bites of mosquitoes.

6. *Immunity due to Sulphur.*—M. d'Abbadil tells us that the native elephant hunters in Ethiopia proceed unmolested by mosquitoes and malaria into the hottest and most malarious districts, and that they attribute this immunity to the fact that they fumigate themselves every day with sulphur. Again, he instances the circumstance that workmen in sulphur deposits situated at low levels in malarial foci are relatively free from malaria, only 8 or 9 per cent. of the sulphur workers being malarious in contrast to 90 per cent. of the population in the vicinity who, following other occupations, are stricken with the disease.

7. Lastly, it may be mentioned that *some people seem to be immune to the bites of mosquitoes, and not to suffer from malaria.* An example occurred in my own person. During one period of leave I was journeying to Cashmere, and had to pass the night on the shores of the Woollar Lake. When I awoke the next morning the inside of my mosquito curtains was positively black with mosquitoes, yet apparently I had never been bitten. Now be it noted that during the whole of my service in India I only once suffered from a slight attack of ague, although I had been stationed in malarious districts.

Finally, before proceeding to detail the symptoms of malaria, I may mention in support of the mosquito theory the effect of irrigation in aiding the prevalence of malarial fever. Hoti Mardan, the station of the Queen's Own Corps of Guides, of which I was for some time the medical officer, gave a striking example of this. In 1887 the canal works from the river, which flowed some thirty miles off, were completed, and irrigation was thus enabled to be applied to the fields near the cantonment. The

admissions for "fevers" in the Guides immediately went up in increasing numbers yearly, thus:—

1886	...	231 cases of "fever" were admitted.
1887	...	453 cases of "fever" were admitted.
1888	...	668 cases of "fever" were admitted.
1889	...	830 cases of "fever" were admitted.
1890	...	1,100 cases of "fever" were admitted.
1891	...	453 cases of "fever" were admitted.

The diminution in admissions in 1891 was due to the fact that the Guides Infantry were away on service, and for the most part encamped on hills 6,000 to 9,000 feet high. In this year, also, throughout the Punjab the mortality from "fevers" was very small. In the next year the admissions again increased thus:—

1892	...	943 cases of fever admitted.

An order was now issued forbidding any irrigation to be carried on within one mile of the lines of the men, with the following results:—

1893	...	270 cases of fever admitted.
1894	...	365 cases of fever admitted.
1895	...	252 cases of fever admitted.
1896	...	250 cases of fever admitted.

With less irrigation, of course, the mosquitoes became less.

SEASONS.

The number of admissions in my regiment by month in the various stations of the Punjab in which I was located, in 962 cases of which I made observation on this point, was as follows:—

January	...	41 cases.	July	...	95 cases.
February	...	11 cases.	August	...	130 cases.
March	...	20 cases.	September	...	164 cases.
April	...	37 cases.	October	...	263 cases.
May	...	39 cases.	November	...	39 cases.
June	...	47 cases.	December	...	76 cases.

It is here seen that the cases increased during the rainy season, and were at their maximum in the month after the rains had ceased.

Clinical Description of an Attack.

A general sketch of a paroxysm shows a cold, a hot, and a sweating stage. The cold stage commences after a period of incubation which has been estimated in duration from three to twenty or more days, with a feeling of lassitude and faintness, soon followed by a subjective sensation of cold, and cold shiverings; the shivering may be so violent as to constitute a rigor. In certain cases, however, this chill may be entirely absent. Next we have violent headache, hurried respiration, and perhaps vomiting. The patient's appearance is very striking, with sunken features, pointed nose, blue lips, shrivelled fingers, and the whole body in a violent rigor—the condition will appear alarming to one seeing a case for the first time. The respiration becomes deeper and slower. The hot stage commences by temporary flashes of heat, until the sensation of warmth is permanent. The appearance of the patient is now very different: the shrunken condition gives place to an apparent increase, the blueness disappears from the lips and ends of the fingers, the face is flushed, the small pulse becomes throbbing, the headache becomes more racking in character. Next comes the sweating stage, commencing with moisture on the forehead and armpits, which is soon copious and drenching all over the body. With this the severe headache passes off, the respiration becomes normal, the pulse less frequent, and the distressing sweating no longer torments the patient. He now will fall into a deep sleep, from which he awakes comparatively well. With regard to temperature, it will be found to rise immediately with the onset of the rigor, to attain its maximum at the hot stage, and then to fall with the sweating stage.

VARIETIES OF MALARIAL FEVER.

Such attacks may occur about the same hour daily, when we have *quotidian* ague or every second or third day, when we have *tertian* and *quartan* ague respectively; or the temperature may not decline during the remission to the normal, when we have *remittent* fever; occasionally the curve is more or less continuous. When the successive attacks do not come on at the same hour, they are called *anticipating* if occurring earlier, or *postponing* if later. When a second attack supervenes before the termination of the first, it is termed *subintrant*. Then as regards the number of attacks on any one day, we may have a double fever, where two such occur. The relative proportion in which some of the above varieties occur I found in 1,066 cases to be as follows:—

Quartan	... 31 cases or 2.90 per cent.
Tertian	... 108 cases or 10.10 per cent.
Remittent ...	... 250 cases or 23.45 per cent.
Quotidian ...	... 299 cases or 28.04 per cent.
Irregular type ...	... 378 cases or 35.45 per cent.

It will thus be seen, according to my experience, the type of fever most commonly occurring in India was one conforming to none of the more definite forms.

DURATION OF THE STAGES.

Generally speaking, the cold stage may last from half an hour to three hours, the hot from one to as many as twelve in severe cases, the sweating from two to four hours.

VARIETIES OF THE HÆMAMŒBA OF MALARIAL FEVER.

Three kinds are found in man, one forming spores every three days, and causing quartan fever, one

every other day, forming tertian fever; and the third the cause of the severe irregular fever of the tropics.

Quotidian ague is caused by a separate infection on successive days of the spores of separate hæmamœbæ of the tertian variety, or by three generations of the quartan ague on three successive days. In addition to these varieties consequent on the difference in the pediodicity we have others dependent on the nature of the symptoms they present, such as the so-called malignant, the cerebral, the gastro-intestinal, the bilious, the algide, the sudorific, and the pneumonic types of the disease. Their symptoms, however, need not detain us. I will merely enumerate in a tabular form the differences of the more common varieties in conclusion:—

Description of Fever.	Duration of Paroxysm.	Character of Paroxysm.		Secondary symptoms, *e.g.*, Headache, Pains in the Bones Vomiting.
		Rigor.	Pyrexial stage.	
Quartan ...	9 hours ...	Very severe	Less severe	Less marked
Tertian ...	11 hours ...	Less severe	More severe	More marked
Malignant tertian	24-40 hours	Most often absent	Very long; often more than 24 hours; false crisis before true crisis	Most severe of all
Malignant quotidian	6-12 hours ..	May be absent	Prolonged, and followed by typhoid-like depression	Very severe

DIAGNOSIS OF MALARIAL FEVERS.

This may be gathered from three points: first, the nature of the periodicity; second, the therapeutical test; third, the result of microscopical examination of the blood. This latter, however, need not

detain us, as it pertains to the visiting physician. As regards the periodicity, the quotidian is no criteria of malaria, as other affections show this: the quartan periodicity is exhibited by no other disease, and the same may be said of the tertian, with the exception of certain cases of malignant endocarditis, which, as shown by Dr. Rose Bradford, may present a chart similar to that of tertian ague—but here the other symptoms present should prevent any mistake being made. With regard to the therapeutic test, in temperate climates a fever that is not subdued in 96 hours by quinine is not malarial; this, however, is not the case in India in my experience, as I have met with cases requiring a longer period of dosage with this drug before the temperature has remained at the normal.

In the tropics the chief disease to be distinguished from malarial fever is enteric fever. At the commencement of the illness it is not always easy to say which disease is present, for in enteric fever the attack may commence with daily paroxysms similar in all respects to ague. When house physician at the *Dreadnought* some years ago I remember four cases of fever all admitted from the same ship, each apparently with typical attacks of quotidian ague; in three of them quinine stopped the illness, but in the fourth it had no such effect and enteric fever was found to be present. The late Dr. Murchison laid down the rule that if in a case of fever the temperature fell to the normal during the first week, it could not be enteric. This holds good for temperate climates, but not for the tropics, for there a case may have its temperature chart reaching the normal in a few days, but yet it will rise again and prove to be enteric. In any case of fever not subdued by quinine in a week the attendant should always in the tropics think of one of three diseases—namely, enteric fever, Malta fever, or abscess of the liver.

Chronic Malaria.

A few words may be said of the chronic form of the disease. Here the patient who has been the victim of many attacks of malaria will present a marked anæmia due to the destruction of his blood corpuscles which has taken place. He acquires a dirty sallowness of the skin. He has an enlarged liver and spleen, with much debility, emaciation, occasional jaundice, disorders of the bowels, dyspepsia, and finally dropsy. With these symptoms there is also a cachectic fever of a more or less continuous type, although fever is not necessarily present.

Preventive Measures for Malaria.

With regard to the prevention of malaria there are, in accordance with the now established theory of the affection, three main indications—namely:—

1. Mechanical protection against mosquitoes.
2. Destruction of mosquitoes.
3. Treatment by prophylactic drugs.

1. *Mechanical Protection against Mosquitoes.*—We have already narrated how Drs. Sambon and Low were enabled to live on the most malarious spot of the Roman Campagna without being seized with malaria by means of a mosquito-proof hut. The same beneficial experience has since been found to hold good on the railway lines traversing the malarious districts in Italy, where, by means of mosquito protection, infection has been prevented. Celli has shown in this respect how mechanical protection by wire or gauze netting in dwellings has been carried out also on the railways, and the good results are beyond dispute. Again, in Sardinia and other places in Europe the same sequence has followed.

In all malarious countries the individual should sleep under mosquito curtains: care must be taken that the latter are free from all holes, rents, or tears. The curtains should be tacked under the mattress, and not disposed hanging down, weighted by the side of the bed on to the floor, for during the day some of the insects will rest under the bed, and then at night find themselves free within the curtain to enjoy their malevolent meal. To prevent the hands and feet being bitten by any proximity to the net during sleep, a frill should be sewn on the net a foot above the mattress. Punkahs must swing above the mosquito net. It is curious to read how that great hunter Mr. Sanderson held his freedom from malaria to be due to sleeping within mosquito curtains long before the mosquito theory of malaria was established.

2. *Destruction of Mosquitoes.*—This need not be entered into at length, as not falling within the province of the nurse. She can, however, should occasion offer, render much service by suggesting certain measures. The larvæ of the anopheles mosquito are found mostly in shallow puddles, small ponds, or drains. They float on the surface of water like sticks, lying flat on the surface. Such puddles in any compound should be obliterated by shovelling in earth. The larvæ of the ponds can be destroyed by adding oil to the water, as it will form a thin film on the surface which will destroy them by choking their breathing tubes. Petroleum, paraffin, or kerosene oil answers admirably; the oil should produce a film over the whole surface of the water, and lasting an hour. Twenty drops of petroleum added to one gallon of water will kill all larvæ in three or four hours. The oil is applied by dipping a rag fixed on a stick into a pot of oil, and then "painting" the pool. The application must be made once a week. Lastly, the adult insects

should, whenever found sleeping on the walls of the bungalow during the day, be destroyed with a fly-flapper.

3. *Treatment by Prophylactic Drugs.*—The two chief drugs that have been used are arsenic and quinine. With regard to *arsenic*, this has been found chiefly efficacious in Italy. In 1880 Crudeli proposed the trial of arsenious acid as a prophylactic to enable the labourers to remain at work on those malarious soils in Italy which were being reclaimed from malaria by high cultivation. In 1882 malarial fever was rife here, and Dr. Ricchi, chief of the medical staff in charge of the Roman and South Italian Railways, gave to 445 workmen one milligramme of arsenic ($\frac{1}{64}$ grain), gradually increasing the quantity to eight milligrammes ($\frac{1}{8}$ grain) daily. Of this number, 338 were either cured of the fevers which they had, or prevented from contracting them; in 43 cases the results were negative, but amongst the latter the drug was not always taken regularly or continuously. In 75 cases the influence of the remedy was doubtful. Ricchi, as the result of this experience, stated "that arsenic, if not always preservative against malarious infection, renders the human organism less and less susceptible to the ferment of malaria." In 1883 the experiments were continued on 78 individuals in the Borino district. At the end of the fever season those who had not taken arsenic had suffered from malaria, many of them severely; whilst the others were nearly immune, 36 out of 39 who had taken the drug had had no fever, and the remaining 3 had had only slight attacks. Similar results have been obtained in Bosnia, in the Tuscan Maremma, and amongst the men employed in the royal chases at Castelpasciano.

In West Africa Crofts found arsenic better than quinine in the treatment of malaria, and advises its use as a prophylactic. In the Ashanti expedition

Surgeon-General Sir William Taylor found arsenic more useful than quinine. Again, my friend the late Dr. Ralph Leslie, whilst acting as Government Medical Officer in the Congo Free State, administered arsenious acid during fifteen days every six weeks. Everyone who took it was immune from malarial fever. Lastly, Tommasi Crudeli has found that the body weight of those treated with arsenic increases, and states "that its action is superior to that of quinine and longer in duration." This action of the drug, whilst producing such good effects in Africa and Italy, does not seem to be equally efficacious in India. Dr. Downie, of the Indian Medical Service, it is true, in his trials of arsenic as a prophylactic agent against malaria, has found his results superior to those of quinine, but I can find no other similar observation. With regard to my own personal experience, during 1866 and 1887 I placed the regiments I was serving with on a prophylactic ration of arsenious acid during the malarious season. The men were all of the same caste and race, so that there was no disturbing intrinsic factor. The result showed in each year the drug to have no influence, the cases in the companies taking arsenious acid giving as many instances of malarial fever as occurred in the companies not taking the drug.

Quinine, on the other hand, in India and elsewhere, except in some parts of Africa, is a sure prophylactic. It has been administered in two ways. Koch gives 15 grains on every seventh day; but Ziemann considers that this dose should be taken every fifth day, as he says a dose of quinine is excreted from the body after four days; others give a smaller dose (2-3 grains) every day. The evidence in its favour is undoubted as a rule. However, as regards the West Coast of Africa, Hartley found it to be of no avail. The bluejackets who took quinine had just as much fever as the men

who did not. In the Ashanti wars of 1873 and 1896 it proved of no avail. The following examples illustrate its good effect. Amongst our French *confrères* Drs. Corré, Marvaud on the Niger Expedition, Kelsch and Kiener, Thorel in Mekong, all speak favourably of it; in America it has been found to be a sure prophylactic; in North Africa in 1889 an inquiry, promoted by Mr. Chamberlain and Sir Patrick Manson, proved its value; thus, of 44 persons who took it regularly, 5 had not any, whilst 37 had, benefit; of 16 persons taking it irregularly, 1 had not any, 15 had, benefit; and of the whole number of cases it was efficacious in 87.7 per cent., and had no result in 12.3 per cent. Another experience in Africa is that of Dr. Parke, the medical officer with Stanley's Expedition. For ten days before entering the mouth of the Congo he gave the officers 4 grains of quinine twice daily. Only a couple of cases of slight intensity occurred, although the party traversed 350 miles of the most unhealthy region of Africa. No other white man has previously travelled the same space of country with the same immunity. One more experience is gained from one of the Benin expeditions. Here all took quinine daily, and, although sleeping on the ground, Dr. Felix Roth, the medical officer, tells us there was no fever.

One could easily multiply instances of like nature. I will in conclusion merely narrate some of my own experiences: In 1889, whilst in medical charge of the 14th Sikhs at Peshawar, the regiment having suffered to an unusual extent from malarial fever during the preceding year at Jhelum, two of the companies were placed on quinine and cinchona, two companies on arsenic, and the remaining four companies took no prophylactic. The result showed that the quinine and cinchona companies had half the admissions for malarial fever of the

four companies not taking any drug. The admissions of the latter and of the two arsenic-taking companies were about equal. Again, in 1896, 50 men of the 2nd Goorkha Rifles at Dehra Doon took 3 grains of quinine daily, and had not a single case of fever, in contrast to an admission rate of 6.5 per cent. for malaria in the rest of the regiment. In 1897, 50 men took again 3 grains of quinine daily with no malaria admissions, whereas the rest of the regiment had 9.8 per cent. of admissions for malaria. The indication, therefore, is obvious: the individual serving in a malarious country should have a daily ratio of 3 grains of quinine for about a month before the commencement of the fever season to its termination. Quinine now is easily and cheaply obtained anywhere in India.

Other prophylactics that may be mentioned are limes or lemons. Dr. Maylieri found these excellent in preventing the attacks. The fresh fruit, rind included, is cut into thin slices, boiled in three pints of water until the fluid is reduced to one-third, then filtered and strained and allowed to cool. M. Colin, again, advises black coffee as a preventive.

Where a house in the tropics consists of two stories, the sleeping apartments should invariably be in the upper one. Elevation above the ground always acts beneficially. In Italy, for instance, the people during the malarial season have learnt to bivouac on platforms propped on poles 5 to 6 metres high. The American Indians, again, have learnt to sling their hammocks on the highest trees they can find when passing the night in malarious regions. Lastly, there should be no vegetable or flower beds near the bedroom window, nor any standing water-tubs kept near the house.

In the actual treatment of a case, when the rigor or other sign occur, the patient should have hot blankets, a hot-water bottle, and such drink as bovril or hot tea. The extra clothes must be re-

moved cautiously when the sweating stage commences, lest the patient get chilled.

The nurse, in addition, must look out especially for hyperpyrexia, and coma, of which I have seen examples, and which demand prompt treatment. Should no medical man be at hand, with the onset of the fever symptoms cold sponging must be resorted to, and quinine injected in full doses under the skin, the permission of the doctor having been previously obtained in the event of such a complication.

CHAPTER VII.

YELLOW FEVER.

THIS is another disease that has been proved to be conveyed through the agency of the mosquito, by the American physicians.

It is an acute specific febrile affection of a limited tropical distribution, occurring in epidemics and endemics. It is caused by a specific organism, as yet undiscovered definitely, and it is communicated by a mosquito, named the *Stegomya fasciata*, and probably only in this way.

GEOGRAPHICAL DISTRIBUTION.

There are three situations in which it is endemic—namely, the West Indies, the Mexican Gulf, and part of the Guinea Coast. From these endemic regions the disease can be transported outside the yellow fever zone, as, for instance, has been the case to England, Gibraltar, and Spain. The endemic zone lies between 46° N. Lat. and 35° S. Lat. This endemic zone corresponds to the distribution of the *Stegomya fasciata*. But mosquitoes are portable, and new localities may constantly become infected by this mosquito, and hence the above limits may increase. When the Panama Canal is finished, Manson has pointed out the danger of the introduction of the disease into Asia, owing to the more rapid means of communication. An infected mosquito

could be shipped and set free alive in Asia, and there give rise to this affection.

Nature of the Poison.

In 1873 Dr. Perry foreshadowed the nature of the poison, in that he described it to be due to a germ. He held that though not demonstrated as yet, nevertheless its existence was rendered beyond doubt by the close analogy between yellow fever and small-pox, scarlet fever and measles. This theoretical opinion has since been amply vindicated. The Congressional Yellow Fever Commission in America of 1878-79 declared the cause to lie in a specific particulate organism, endowed with the vital properties of growth and reproduction, whilst yellow fever patients were the most frequent cause of its spread from place to place, more epidemics having resulted from persons sick with the disease than from any other cause.

With regard to the nature of this specific particulate germ, Dr. Domingos Friere, Commissioner of the Brazilian Government, made a series of researches, and in 1883 embodied his results in a report presented to the Academie des Sciences and to the Biological Society of Paris. His researches, carried out with the aid of M. Rebourgeon, demonstrated by inoculation and inhalation experiments on guinea-pigs, the presence of a specific cryptococcus, which secreted a poison acting on the body of the host affected. Other observers have also described a specific organism, such as the *bacillus ictcroidcs* of Sanarelli, the bacillus of Durham and Myers, and the *Tctragcnus febris flava* of Finlay. There can, we think, be no doubt that a specific organism does exist; how does it act? In 1881 Finlay, of Havana, first drew attention to the transmission of the disease by mosquitoes. He caused a mosquito to bite a yellow fever patient, and then to

bite an individual who had not had the disease. The latter then caught yellow fever. From the results of his investigation he held that yellow fever was communicable by inoculation, and only became epidemic when such inoculation was brought about by the mosquito.

In 1900 the proof was definitely established by Drs. Reed, Carroll, Agramonte, and Lazear, who concluded the *Stegomya fasciata* to be incriminated. Drs. Lazear and Carroll incurred the disease during the experiments, the former unfortunately succumbing. The investigations were carried on in Cuba, a small camp of non-immune men being formed in an open field. After this had been occupied long enough to show that yellow fever in its stage of inoculation was not present, five of the men were bitten by infected mosquitoes, and in from three to five days each was seized with a well-defined attack of yellow fever. In a second series of experiments, four non-immunes were injected with blood from yellow fever patients; each was attacked with the disease, whilst four other men who had suffered an attack from infection transmitted by mosquitoes manifested no bad effect from a similar injection. A third series of experiments was made with clothing and bedding contaminated with the discharges of yellow fever patients or worn by them. A small unventilated hut was built, its interior guarded against mosquitoes by wire screens. Three men, all non-immunes, passed twenty consecutive nights in the hut, sleeping in the contaminated sheets and blankets. After this a fresh stock of soiled articles, including pyjamas, undershirts, and nightshirts, in addition to bedding, was obtained from the fever hospital, and the non-immunes occupied the room for twenty-one nights. This experiment was repeated a third time for twenty nights by two other non-immunes; yellow fever was not developed in any of these cases. Meanwhile another

small hut was built, well ventilated, and divided by a wire screen from the floor to the ceiling in the middle, thus dividing it into two compartments. Every article before admission into this room was disinfected by steam. A non-immune was admitted into one of the compartments, into which fifteen infected mosquitoes had been set free, and bitten. He incurred yellow fever. The other compartment was occupied by two non-immunes for eighteen nights, with freedom from attack. These experiments thus proved that the disease is transmitted by the bite of the infected special mosquito, and is not transmitted by fomites arising from infected clothing or bedding.

SYMPTOMS.

The onset is usually sudden, with intense headache, rapidly rising temperature, and great lumbar pains with prostration. The face is flushed, the eyes "ferrety," with sometimes a band of congestion across its middle region. A certain amount of jaundice manifests itself early, with the loin pains and intense headache, whilst there is also epigastric tenderness. The pulse at first rises in frequency up to 130, but soon begins to fall, often to 50, whilst the temperature ranges from 100° to 107°, rising rapidly to a maximum on the second or third day. This *febrile* is then succeeded by the *calm* stage, where the temperature quickly falls to normal or subnormal, whilst all the above distressing symptoms abate, so that the patient may declare himself to be well. He is not so, however. The urine is now slightly albuminous, and in a short time there is an acceleration of all the symptoms; the tongue becomes bright red, dry, and glazed; there is great epigastric tenderness, with burning pain, and vomiting, which in the large number of cases assumes the character of "black vomit"—hæmorrhagic vomiting. The

skin now attains its yellow tint, from which the fever obtains its name. In addition we find hæmorrhages occurring from the vagina, nose, mouth, gums, throat, ears, eyelids, and cutaneous surfaces, in an "unexampled range," as described by Surgeon-General W. C. Maclean. The motions are either clay-coloured or black. Death finally occurs from asthenia or uræmia. It will thus be seen that the following six symptoms, associated with a fever of one paroxysm in a patient apparently exposed to infection, and who has never had yellow fever, indicate the appearance of this disease: —

1. Sudden attack, with violent frontal and lumbar pain, ferrety eyes, and marked superficial capillary congestion.
2. Want of correlation between pulse and temperature.
3. Albuminuria.
4. Black vomit.
5. General hæmorrhagic tendency.
6. Yellowness of skin.

For the foregoing brief description of the fever I am indebted to Drs. Izett Anderson and Bemiss, as I have personally never seen a case.

THE NURSING OF A CASE OF YELLOW FEVER.

This is of the utmost importance, and, if possible, should only be entrusted to an experienced nurse, preferably also to one immune to the disease; she should try to dispel the dread that is usually present with these patients.

As regards prophylaxis, the physician will have recognised the first cases and promptly have isolated them; and here it is to be noted that a mild case can be just as dangerous as regards its power of propagation as a severe one. Special attention must be paid to the mosquitoes; the patient's bed protected by mosquito netting, and in addition all

the mosquitoes in the neighbourhood be destroyed as far as possible. "The fact that these mosquitoes do not of themselves travel far abroad, make it probable that they are still within the house." Their breeding places should also, of course, be destroyed, as already narrated in the chapter on malaria. The *Stegomya fasciata* is an essentially house mosquito, and does most of its biting by day. It makes but short flights, rarely more than one hundred yards. But one fact must be remembered—that this variety of mosquito has been known to live over five months, and to communicate the disease two months after becoming infected. Hence they must be rigorously sought for and killed in a house or tent wherein lies the patient. It should be noted that the patient ill with yellow fever can only infect the mosquito during the first three days of the illness, and again that the mosquito so infected cannot propagate the disease until twelve days have elapsed after its infection.

Various drugs have been proposed as prophylactics. Cummins recommended quinine, but with others this has proved useless. Walker, of Jamaica, again, advocated mercury for this purpose.

Preventive inoculation.—Dr. Domingos Freire advocated a certain prophylactic fluid for inoculation. The organism to which he attributed the fever he held to secrete a ptomaine which acted as a virulent poison. By a series of cultivation this virulence is attenuated, and then the cultivation liquid when inoculated forms the prophylactic against the disease. Dr. Freire inoculated 500 individuals, and not a single case of yellow fever appeared amongst them. Included in this number were 150 porters and labourers, employed in the port loading and unloading vessels, and therefore especially exposed to the infection by every infected mosquito present: they remained exempt, though surrounded by uninoculated fellow-workers, who were struck down by it.

The captains and all the crews of three English vessels had been inoculated, and every man escaped infection. His later results were equally satisfactory. From December 22, 1884, to March 22, 1885, 1,109 persons of different nationalities, whose ages ranged from one month to sixty years, were inoculated in the deltoid region. Not one single case was severely attacked, and the very few who suffered from the fever had it in the mildest manner possible. Again, the results for December 1885, January and February 1886, were as follows: No deaths occurred amongst 3,051 inoculated persons, whereas in the same localities 278 unprotected individuals died. Lastly, Dr. Isastier found in Rio Janeiro the mortality to be 1.6 per cent. amongst the inoculated, but 13.7 per cent. amongst the uninoculated. Since the publication of these results, however, the practice of preventive inoculation seems to have fallen into abeyance; whilst the conclusions of the French (Pasteur Institute) Commission in Brazil in the matter of immunising sera from convalescent yellow fever patients hold that we are not in possession of any tried and proved serum treatment. If the results quoted above were facts—and there seems no reason to doubt it—it is difficult to see why this treatment has not been further prosecuted.

The diet during the first twenty-four hours should be practically starvation. *Vomiting, constipation, suppression of urine, hyperpyrexia*, are the important symptoms to note and to bring to the notice of the attending physician. Lastly, it may be stated that formerly it was held necessary to disinfect all articles of clothing, bedding, or merchandise contaminated by contact with the sick. This is now stated to be unnecessary. Attention is now paid only to mosquito extermination and protection from infected mosquitoes as regards prophylaxis. The success of this method is at once demonstrated by the example of the successful campaign

against mosquitoes carried out by Colonel Gorgos in Havana, whereby yellow fever has been banished from that city, after more than a hundred years of continuous prevalence. In Cuba, previous to 1901, the average mortality from the disease was 467. In the year succeeding the inception of the operations against the mosquitoes, the mortality was only five, and now the city is quite free from this fever.

CHAPTER VIII.

ACUTE CROUPOUS PNEUMONIA.

PROBABLY it may be surprising to see pneumonia placed amongst the tropical diseases, as it is generally held to be associated with cold weather. But as we shall presently see, this notion is not correct. I personally have found pneumonia one of the most frequent diseases met with in hospitals in India, after eliminating bowel complaints and malaria.

NATURE OF PNEUMONIA.

When I was a student of medicine, pneumonia was held to be a local disease of the lung. This, however, is no longer the view that is taken of the disease. Pneumonia is, in fact, as defined by Professor Osler, "an infectious disease characterised by inflammation of the lung." The lung affection may be compared to the skin manifestations in scarlatina and small-pox; no one would describe these diseases as being those of the skin.

ETIOLOGY.

The credit of first establishing pneumonia to be due to an organism belongs to Dr. Friedlander, a former first assistant in Professor von Recklinghausen's laboratory at Strasburg. When working with him there in 1887 I had the advantage of hearing his views on the specific nature of pneumonia.

As the result of much long and patient work he at length described his pneumo-bacillus in a paper, in which he published its constant presence in the alveolar exudation of croupous pneumonia. Subsequently he and Frobenius, from an examination of 50 cases, demonstrated its constant appearance; whilst by inoculation and inhalation experiments on mice and guineapigs he established its causal relation, for he found no pneumonia to follow his control experiments in which he first sterilised the inoculated particles. He failed at first to find the organisms in the blood of his patients, but at length discovered them by cultivating this blood on sterilised blood serum. His results were confirmed by M. Talamon at the Hotel Dieu, Dr. Afanasieff at St. Petersburg, and Maguire at Manchester.

Subsequently to Friedlander, Fraenkel and Weichselbaum independently showed the existence of another organism—the diplococcus pneumoniæ. This latter organism is now held to be responsible in a greater degree than that discovered by Friedlander for the causation of the disease.

Clinical evidence is in abundance to show that pneumonia is an infectious disease. Dr. Flindt, at the International Congress at Copenhagen, stated that the disease never appeared equally spread over the population, but always in small local epidemics —often purely domestic. So that he came to the conclusion that intercourse between the healthy and the sick played an important part in the spread of the disease. Professor Osler in Philadelphia again showed from a considerable body of evidence the occurrence of pneumonia in an epidemic form, and affecting certain localities, such as barracks. Dr. Bryson also many years ago described epidemic pneumonia occurring in the Mediterranean Fleet. He especially remarked on its resemblance to the pleuro-pneumonia of cattle, and believed that the sick

landed from the fleet at Malta communicated the disease to other patients in the hospitals. But the best proof of the specific nature of pneumonia, uniting both the pathological and clinical evidence, was afforded by Emmerich, of Munich. A certain prison at Amberg had for a long series of years been constantly the theatre of the disease. After an exhaustive process of exclusion Emmerich examined the material filling the interval between the floor of one room and the ceiling of the room below it. This material, by culture experiments, showed the presence of Friedlander's organism. There can be no doubt, therefore, that pneumonia is in truth an infectious fever. Why the disease at one time should spread, and at another time not do so, we can no more explain than we can similar facts with the acute exanthematous fevers. Of pneumonia, however, it may be said that as a rule it is not so powerfully infectious as is the case with the infectious exanthematous fevers.

RELATION OF PNEUMONIA TO COLD.

Does pneumonia prevail more in cold climates than in hot? or are there any grounds for expecting to find it occupying a prominent place amongst tropical diseases? Now, in the first place, Dr. Flindt showed in his paper above-mentioned that as the result of his researches extending over a long series of years, the atmospheric condition of "cold" had no relation with the disease: in only 8 per cent. could he demonstrate any exposure to cold; whilst in 92 per cent. this was excluded altogether. And in the "American Journal for Medical Sciences" for July 1882, Dr. Sanders, in a valuable paper on the prevalence of pneumonia in hot climates showed that the disease, "other things "being equal, increases uniformly in frequency the "nearer we approach the tropics. That is to say—

"and this fact is a surprising one, and one distinctly "opposed to its presumed dependence on cold—the "disease is more frequently met with, and is more "common, in warm than in cold climates, and in hot "than in warm climates, showing a gradually in- "creasing rate from the Pole to the Equator." Extreme nearness to the latter, however, qualifies this statement, for Sanders found that after a certain parallel was reached it again became less common. Other relations with the tropics were also found to exist. Thus the nearer we approach these regions, the higher is the mortality. Statistics for warm climates, based on the returns of 157 cities, show an average of 1.70 deaths from pneumonia per 1,000 of the population; whilst those for fifteen cities in the temperate zone show an average of 1.31 deaths per 1,000.

In India pneumonia was, in my experience, frequently met with in the Punjab. On the N.-W. Frontier it occurs in epidemics. And here I may cite an example that fell under my personal observation. In November 1885 I joined the 23rd Pioneers as medical officer on their return march from the Pishin Valley, where they had for some months previously been engaged in making the Hurnai railway. We reached cantonments at Umballa on November 25th. From November 29th, 1885, up to April 1886 the men were constantly coming into hospital with the disease. Various theories were held as to its causation. It was held that the men caught cold from being inadequately clothed, but probably no regiment in the native army was better looked after in this respect. In addition to the ordinary dress of the native soldier, each man, amongst other things, had been provided, before starting from the Pishin Valley, with a thick sailor's jersey. Again, it was held that the regiment had returned to Umballa broken in health. The follow-

ing was the daily admission rate for the regiment for the years 1881, 1882, 1883, 1884, 1885 : —

1881	... ...	39.65 per 1,000
1882	... ...	37.29 ,,
1883	... ...	22.53 ,,
1884	... ...	18.55 ,,
1885	... ...	31.41 ,,

At first sight, the admission rate for 1885 seems greatly in excess of that for 1884 ; but on examining carefully the rate for 1885, I found the following circumstances to have existed. The great bulk of the regiment was in the Hurnai Pass up to April 18th ; from April 18th to November 16th it was in the Pishin Valley ; from the latter date it was travelling to Umballa. Now, on analysing the daily admission rate the following ratios came out : —

From January 1 to April 18 the rate was	25.74	per 1,000
From April 19 to November 26 the rate was	19.61	,,
From Nov. 27 to December 31 the rate was	39.40	,,

Hence the large bulk of admissions occurred *after* the regiment had returned from Pishin.

Thirdly, it was held that a white fog that prevailed about the lines in January caused the disease. But the latter continued, although the fog ceased. Lastly, the cold of the Punjab from December to February was stated to have been the cause. This, however could not have caused the disease when the warm weather set in. The table given on the next page shows the temperature taken in hospital during the prevalence of the affection : —

Looking at this table we find that at 6 A.M. the temperature ranged from 48° F. to 78° F. ; at noon from 54° F. to 94° F. ; at 6 P.M. from 50° F. to 92° F., during the period of the epidemic, or with ranges at these hours respectively of 30° F., 40° F., and 42° F.

As the cases, notwithstanding the onset of the hot weather, continued to come into hospital, my con-

Case. No.	First Day of Illness.	Temperature in Hospital on First Day of Illness. 6 A.M.	12 NOON.	6 P.M.
1	—	Not taken	—	—
2	—	,,	—	—
3	—	,,	—	—
4	—	,,	—	—
	1885.			
5	Dec. 6	57°	64°	65°
6	,, 6	57°	64°	65°
7	,, 7	55°	62°	64°
8	,, 6	57°	64°	65°
9	,, 6	57°	64°	65°
10	,, 8	56°	61	64°
11	,, 9	59°	64°	64°
12	,, 10	57°	63°	64°
13	,, 15	56°	64°	64°
	1886.			
14	Jan. 3	52°	55°	55°
15	,, 11	54°	61°	59°
16	,, 21	56°	61°	59°
17	,, 21	56°	61°	59°
18	,, 31	52°	58°	59°
19	Feb. 3	48°	54°	58°
20	,, 9	50°	60°	69°
21	,, 15	55°	65°	64°
22	,, 23	55°	65°	69°
23	,, 22	51°	62°	50°
24	March 2	59°	71°	70°
25	,, 4	61°	71°	70°
26	,, 15	66°	75°	74°
27	,, 25	67°	75°	74°
28	,, 30	73°	80°	79°
29	April 4	62°	75°	73°
30	,, 6	65°	76°	74°
31	,, 14	76°	84°	83°
32	,, 18	75°	88°	88°
33	,, 26	78°	94°	92°

viction that we had here a specific infectious fever became more and more strengthened, and on April 1st the commanding officer, on my recommen-

dation, had the men transferred to tents, whilst their lines were evacuated. The latter were fumigated with sulphurous acid, and on the day following all the apertures in them were opened and they were freely ventilated. On the third day they were reoccupied. By April 14th all the lines had been so treated except those of the band. On April 14th case 31, that of a musician, occurred. On the 15th the band went into tents. Two cases only subsequently occurred — one on April 18th in the married lines, the other on April 26th in the band lines. Both these cases occurred nine days after the lines had been reoccupied, or eleven days after they had been evacuated for disinfection. But if the pneumonia were a specific infectious disease, a period of incubation would be necessary, as is the case with other infectious diseases. This period, it is not too much to assume, may be as much as eleven days or more, and so the disease would have been actually caught before the lines in question were evacuated. That such was the case obtains support from the fact that during all these months measles had been present in the married lines. Subsequent to the disinfection three cases of measles occurred—two on April 17th in lines disinfected on the 13th, and the third within a week from the disinfection. Now the incubation period in measles is stated to range from seven to twenty-one days. Hence it is probable that all these cases were beginning as regards incubation before the lines were disinfected.

After case No. 33 had occurred the disease ceased entirely.

We now pass on to the *symptoms* of acute pneumonia. This disease usually begins with a distinct rigor, followed by a sharp stabbing pain in the side with rapid, difficult breathing, the pain being due to the implication of the pleura covering the lung. He lies in bed with flushed cheeks, and has

an anxious expression; his nostrils are seen to be working. The cough is short, frequent, and dry at first, but soon succeeded by the expectoration of a viscid rusty coloured expectoration, so viscid that it will remain in the cup when the latter is inverted. Its frequency is due to the difficulty the patient has in expectorating this tough mucus, whilst its shortness is due to the pain caused by the act.

With the rigor the temperature rapidly rises to 103° or 104° F. The physician, on arrival, will either at once detect the physical signs of pneumonia, or these may not be evident till the next visit, owing to the inflammation commencing in a deep portion of the lung. Another sign that will be evident to the nurse is the peculiar burning feel of the skin, the latter giving one the impression of heat more than in any other disease.

The Nursing of the Patient.—Pneumonia is another disease in which good and efficient nursing is imperatively demanded in the interest of the patient. He must at once go to bed. The room in which he lies must be kept well ventilated; the bedclothes should be light, so as not to distress him by their weight. He himself will quickly assume the position in which he feels the greatest ease, and there will be no occasion to shift him from time to time, as is found useful in bronchitis, with the view of provoking cough and the expectoration of mucus, for our object is not to exhaust him in any way, but to support his strength till the crisis arrives, and not tax his strength in any way. What secretion there may be in pneumonia comes from the diseased portion of the lung which is already airless and useless for respiration purposes.

Until the arrival of the physician the nurse may apply fomentations or a linseed poultice. The physician may order hot linseed poultices, to be changed every four hours, or he may treat the case with ice-

bags after the method pursued by Dr. Lees; or, again, some prefer blisters.

In hospital practice in India I always found a difficulty in getting my hospital assistant to keep the poultices properly renewed, so that I preferred simply to envelop the patient's chest in a cotton-wool jacket, or else to apply a blister. If there be excessive pain the application of a few leeches is indicated. The patient must be kept perfectly quiet; he should not be allowed to talk.

The more special points to be noted by the nurse are the pulse, temperature, and respiration, which should be taken regularly; the management of the sputum; the character of the cough; any complaint of pain in the chest; any delirium; the state of the bowels; the amount of urine passed; and the prevention of bed-sores.

The great danger in pneumonia is the supervention of cardiac failure. Should the pulse rise to 120, the attention of the physician should be drawn to this, so that measures may at once be taken. This danger must ever be borne in mind; even after the crisis has passed the patient must not be allowed for some days to raise himself in bed lest sudden failure of the heart ensue.

This complication is the more to be feared, of course, in hot climates, owing to the exhaustive effect of heat. Let us now consider the various points in the treatment of pneumonia in detail.

Position of the Patient in Bed.—The sick individual will, as previously mentioned, soon find the easiest position for himself, which will usually be in the recumbent position. Cases, however, occur in which he cannot breathe without difficulty when recumbent; he must then be propped up with pillows. But as a rule, the patient's head should not be raised.

The pulse, temperature, and respiration should be taken regularly every four hours. In pneumonia

the temperature falls as the general rule by crisis, after remaining high for from five to eight days. Usually, unless hyperpyrexia occur, we do not try to reduce the temperature, for it only lasts a few days, and therefore no very harmful effect is excited on the tissues. The rate of respiration is quickened out of proportion to the pulse always. This marked increase in the frequency of the respiration is very characteristic of the disease.

We have already spoken of the danger of heart failure. The nurse shall therefore be on the look-out for the symptoms of this complication, which is indicated by a rising pulse, danger being indicated when it reaches 120. The action of the heart becomes irregular and tumultuous, and the face becomes blue. These symptoms being noticed, the physician's attention should be at once directed to them. He will then probably also find the first sound of the heart progressively weakening. In the treatment of cardiac failure alcohol is needed and the subcutaneous injection of strychnine indicated.

The Sputum.—The nurse should always be especially careful that some antiseptic, such as carbolic acid (1 in 40) or corrosive sublimate solution (1 in 1,000), be placed in the spittoon, as if any of the sputum become dried, and is given off into the air, a source of infection will be present to attack other individuals.

The Bowels.—There is often constipation in pneumonia. This need not cause anxiety. There is no occasion to give purgatives, as by so doing we may cause a severe diarrhœa at the time of crisis, when there is frequently a tendency to diarrhœa, which would thus be aggravated.

The diet must be light, nourishing, and liquid. Give milk with one or two raw eggs; some albumin water, made by adding the beaten white of an egg to six ounces of water, and adding a teaspoonful of

lemon-juice, will be found very palatable to the patient. Or milk and seltzer water may be allowed freely, three to four pints per diem. The patient's thirst can also be quenched by "Imperial Drink," made by adding a teaspoonful of cream of tartar to a pint of boiling water, into which the juice of half a lemon is squeezed. Brand's essence and Valentine's meat-juice are also excellent. In most cases starches and sugars are best omitted from the diet. Fruit may be given at any time during the affection, and especially during convalescence. No solid food should be given till the fever has subsided.

Alcohol will be found more needed in the tropics than in temperate climates. We have already drawn attention to its necessity when the symptoms of heart failure supervene. It should also be given when the tongue is dry and brown with low muttering delirium. Alcohol can be generally given with a certain amount of freedom, as the fever is of comparatively short duration. It, of course, is especially needed where the patient has been accustomed to take freely of stimulants. I remember a case when I was house physician at the Seamen's Hospital, Greenwich, in which the patient—a drunkard—had to have administered to him half an ounce of brandy every hour in order to save his life.

Sleeplessness.—This must be combated in order to save the patient's strength. Chloral hydrate with potassium bromide, fifteen grains of each, with half a drachm of sal volatile to counteract any tendency to depression, is often of use. Paraldehyde is most useful, and is held by some authorities to be almost specific in the treatment of insomnia in pneumonia. Its objection is its nasty taste and the offensive smell it gives to the patient's breath. This may be in a measure counteracted by giving it in an almond mixture.

Bed-sores.—These have already been considered under Enteric Fever.

A few words may be added as to the treatment of the disease in *children*. Here sponging the body gives great relief; special care must be given to the diet; milk very frequently causes the abdomen to become distended, whereby the action of the heart is seriously interfered with. Hence it should be given freely diluted and peptonised. Water may be also taken freely. The bowels should be evacuated once a day. Should the temperature in a child mount very high, and be accompanied by restlessness and nervous symptoms, it must be reduced by tepid sponging or cool packs. Paul draws attention to the frequency of the appearance of cold and clammy feet in this class of case, and recommends a hot foot-bath, which will be found of the greatest benefit.

In concluding this subject of pneumonia, I would place on record that, as regards the actual treatment by drugs during the epidemic at Umballa mentioned that came under my care, the most successful treatment followed the administration of vinum ipecacuanha and vinum antimoniale. This latter drug at once eased the pain and the cough, and the pulse improved. It did not exert any depressing effect on the patients, although they were natives of India, and as such might be expected not to bear this drug well. I have always treated my cases with antimony, and although this medicament would appear to have gone out of fashion, yet I consider it a most potent drug for good in pneumonia.

CHAPTER IX.

SCURVY.

IT may, perhaps, be thought that scurvy is not a tropical disease, but as regards the British Empire it may be said that at the present day more cases of scurvy will be met with in the tropics than at home. This disease was formerly rife in our fleets, but this is no longer the case. When I was house physician at the Seamen's Hospital, Greenwich, in 1874, not a few cases of scurvy were admitted into the wards. But the ships of the Merchant Navy now carry lime juice with them, and in consequence it has become practically extinguished in the merchant service. During the last seven years, since I have had charge of in-patients at the Branch Seamen's Hospital, I have only seen two cases.

Scurvy, however, occurs not only at sea, but also on land. In the Punjab and North-West frontier of India, many cases are met with. Thus, shortly after my arrival in India in 1878, I was appointed a member of a medical board to report on the medical state of health of one of the native regiments in the Kurram Valley Field Force in Afghanistan. We found the whole regiment more or less, while quite half the battalion were markedly affected by the disease, so much so that it had to return to India, as it was unfit to undergo the fatigues of the campaign.

Causation.

Several theories have been held as to its causation: (1) Villemin held it to be a disease *analagous to typhus fever*; (2) *Damp cold air* has been considered an essential cause, inasmuch as it occurred on land and sea under this condition. In 1886 in the Hill Station at Chakrata in India an outbreak occurred with 56 admissions. The rainy season was on, and the dampness and depression of spirits induced in the British soldier from having nothing to do, may have been causative, as scurvy did not show itself till the rains were well established, and "on their "cessation the curative effect of the dry bracing air "was simply marvellous." The rations were good, as the men had fresh meat, 12 oz. of fresh potatoes, and 4 oz. of onions daily. (3) *Insufficient ventilation* predisposes to it. The 21st Native Infantry had scurvy in the Abyssinia War of 1867-68, which became greatly aggravated during their return voyage to Bombay, consequent on the hatches being closed owing to the rough and boisterous weather encountered. (4) But there can be no doubt that apart from damp cold air the cause of scurvy is a *dietetic* one. Several theories have been set forth. Thus (*a*) *ptomaine poisoning* has been upheld by Torup of Christiania, who states it arises from poisoning caused by badly preserved meat and fish. (*b*) *Deficiency of potash* in the blood was put forward by Sir Alfred Garrod, who pointed out that in all scorbutic diets potash existed in much smaller quantities than in those capable of maintaining health, and that all antiscorbutics contain a large quantity of potash. But the giving of nitrate of potash will neither prevent nor cure scurvy. (*c*) Buzzard held that scurvy was caused by *deficiency of potash combined with deficiency of the organic acids*. (*d*) This view was amplified by the late Dr.

Chas. H. Ralfe, when physician at the Seamen's Hospital, Greenwich. This most able physician and authority on tropical diseases showed that in scurvy *the neutral salts, such as the chlorides, were either increased relatively at the expense of the alkaline, or that the alkaline salts were absolutely decreased.* In animals when the alkalinity of the blood is reduced artificially dissolution of the blood corpuscles, ecchymoses on the mucous surfaces—states found in scurvy, are induced. This view fully explains the action of salted provisions, and salted water in producing the disease. (*c*) The most recent view is that of Professor Sir A. Wright, who considers the disease to be *an acid intoxication of the blood.* He shows that in the carnivora there exists naturally a very effective provision for neutralising the acids by means of the waste ammonia of the body: in vegetable feeders such as rabbits this does not exist, and they speedily succumb to the "acid intoxication," whereas the carnivora can stand a considerable quantity of acid infection. Man occupies an intermediate position between the rabbit and the dog. Now if fresh vegetables be excluded from the diet the acid of the animal food predominates. This reasoning of Wright explains the successful treatment by fresh vegetables, lime juice, or of fresh meat with the blood in it, for blood is an alkaline food stuff. So much for the theory of Wright. Captain Lamb, I.M.S., failed to substantiate it, however, as he found no acid intoxication in eleven cases of scurvy, nor did he find any benefit from the treatment recommended by Wright. (5) Glyn-Liston, of the I.M.S., advocate that *ankylostomata* are the cause of the disease, but this view will not hold water, for the number of cases was too small to draw any conclusions from: the presence of ankylostomata was probably merely a coincidence in the patients on whom the theory was based; and, lastly, Lamb

doubts if the cases were those of scurvy at all. (6) Lastly, the disease has been recently held by Coplans to be due to the specific infection of some bacteria, from the evidence he obtained in the late South African War.

In connection with the liquid elements of the food, it may be mentioned that the late Dr. Stephen H. Ward, Senior Physician to the *Dreadnought* Hospital, believed that *condensed water* acted as a predisposant, for he found that in merchant ships bound from Aden scurvy existed, notwithstanding the introduction of lime juice, often with its old severity. The crews drank condensed water. Dr. Beckler, the medical officer to Burke's exploration in Australia, traced the disease again to the use of *stagnant water*, those drinking this being affected, whilst those who were able to obtain good water did not become so, the supply of the other articles of diet being similar to all. Lastly, the water percolating through the soil called "*reh*," in certain parts of India, should be avoided. This contains sulphate and chloride of sodium. Dr. Verchere, of the Bengal Army, reported some years ago an outbreak due to drinking the water from this soil.

Symptoms.

These are those of "a general non-febrile and apyretic disorder, consisting of "mental depression, extreme debility, a tendency to syncope, and special lesions of the mouth, skin, and muscular system"—(Johnson Smith). There is much shortness of breath; the skin is dry and earthy-looking. Pains in the back and limbs are present. Next appear petechiæ, chiefly in the lower extremities, but subsequently elsewhere. Succeeding them are found to be subcutaneous hæmorrhagic swellings in the calves and popliteal spaces. The gums swell, and encroach on the teeth, are soft, easily bleed on

being rubbed, and are pulpy. But where any teeth are absent this swelling does not take place. They may ulcerate or slough, and the breath becomes very offensive. Any slight injury causes an effusion of blood into the part; effusion of blood occurs under the periosteum, forming "scorbutic nodes." The face becomes puffy, the shortness of breath more urgent, and the beats of the heart progressively become feebler.

TREATMENT.

A Prevention.—The nurse and everyone in the tropics should always take plenty of vegetables in their diet. If she be in a locality where fresh vegetables cannot be obtained, preserved, but not dried and compressed, vegetables must be taken. The process of drying weakens the antiscorbutic principle of vegetables. This was well shown in the American War of Secession. The albumen and salts are carried away by the water expressed from them, and there remains only the framework of the tissues. With the preserved vegetables lime juice should be also given. The good effect of *lime juice* has ever been shown in our campaigns; for instance, it formed part of the rations in the New Zealand, Ashanti, Duffla, Sunjhi-Ujong and Malay, Zulu, Egyptian, Aka, Eastern Soudan, Dongola, and Bechuanaland wars and expeditions, and no scurvy occurred; whilst, where lime juice was not provided, the disease has appeared to a great extent: witness the Suakim Expeditionary Force of 1885; here green vegetables were scarcely ever issued, fresh meat was rarely provided, and there was no lime juice. There was scurvy to the extent of 70 per cent. Three to four ounces, mixed with about eight times this bulk of water, should be taken daily.

Should there be no lime juice at hand, *vinegar* may be tried. In Afghanistan one morning a man was admitted into my hospital for scurvy. I in-

spected the battery that day, and found several of the men in like manner affected. We had no lime juice in camp; in default a ration of vinegar was ordered, and no more cases occurred. A diet of fresh meat will also protect from the disease. In 1881 Dr. Neale was isolated for ten months on Franz Joseph Land. No lime juice was served out, and the vegetables were extremely scanty. The diet was fresh meat with plenty of blood in it. Blood is an alkaline foodstuff. Each man had 1 lb. of frozen fresh blood when a bear or walrus was killed, and scurvy did not appear. Again, my friend Surgeon-Major G. Griffith, of the 18th Bengal Lancers, stopped an outbreak of the disease, when P.M.O. at Suakim in 1885, by causing the men to eat their rations immediately after the animals had been killed.

Professor Edmund Parkes, the former well-known Professor of Hygiene at the Army Medical School, Netley, suggested the use of *bitartrate of potash* used as salt at meal times. Again, *phosphate of potassium* has been brought forward by Meade, Galloway, and Anderson. "Their theory is in-"genious but not convincing." In many of the expeditions on the Indian frontier "*amckur*" has been issued to the native troops for this purpose. It has antiscorbutic properties, is a mild laxative, and is greatly liked. In the Chitral expedition "*kokum*" was tried for native troops and followers, but only the Madrassis and some troops from Poona would take it. It is the dried "kuronda" fruit, and is very astringent and provocative of bowel disorders.

Lastly, in accordance with his theory, Wright recommends as a prophylactic 20 grains of *neutral tartrate of sodium and potassium* (Rochelle salt) with 5 grains of crystallised *calcium chloride*. He objects to lime juice and fresh vegetables as not being portable, and as slow in their action, whilst he

states that lime juice aggravates the defect in coagulability. I am unaware of any observation of the prophylactic effect of these salts; but, with regard to the action of lime juice being slow, it has, on the contrary, been remarkably quick in its action according to my experience. So much for the preventive measures of scurvy.

As regards the actual treatment of a case, the nurse must take especial care that the patient maintains the recumbent position in bed. A sick man affected with bad scurvy, when first seen, appears alarmingly ill and in the greatest state of exhaustion; under the exhibition of lime juice he at once begins to improve, and unless watched may take liberties with himself—sitting up in bed or otherwise exerting himself. Many such severe cases have been lost thus by getting a sudden attack of syncope, from which no recovery occurs. Hence the patient must also be dressed carefully, without needlessly moving him. The remedies for the ulcerated gums, etc., will, of course, be ordered by the visiting physician.

CHAPTER X.

PLAGUE.

The nurse, after landing in the Tropics, will in all likelihood be brought into contact with plague, especially if she serves in India. This virulent disease has now, since September 1896, been ravaging that country; whilst it is somewhat difficult to see how it is to be eradicated, owing to the peculiar environment it meets with in the East, due to the crowded bazaars and the religious and social customs of the natives. To give some idea how it has flourished in India, the following figures are cited: It was imported into the city of Bombay in 1896 from Hong Kong (where the outbreak occurred in 1893-94), when it burst out as an epidemic in September. From Bombay city it spread to the Presidency, where it has continued ever since, and has caused, as Professor Simpson tells us, 1,500,000 deaths up to the end of April 1907. It has spread gradually to the other provinces of the country, and has occasioned up to May 31, 1907, 5,402,245 deaths. The total population in India is about 300,000,000, so that this mortality means about one death in every sixty inhabitants. The mortality of the later years has been much greater than that of the earlier, as shown in the following table: —

	Cases.		Cases.
1896 ...	1,704	1903 ...	851,263
1897 ...	56,056	1904 ...	1,022,299
1898 ...	117,953	1905 ...	950,863
1899 ...	134,788	1906 ...	332,181
1900 ...	93,150	1907 (Jan. 1 to May 31)	991,003
1901 ...	273,559		
1902 ...	577,427		

One of the most serious aspects of the case is the fact that the Punjab is now the seat of a portion of this large mortality, for from the Punjab are drawn our most valued recruits, hence it can be easily imagined how the Indian Army must suffer. This province has lost nearly 1,700,000 of its inhabitants; and this sum will at once be seen to be very high when we consider that the Punjab is in size less than one-twelfth of the total area of India, whilst it contains less than one-eleventh of its total population. Simpson quotes the following extract from the *Times of India* of June 1, 1907: "To dismiss this "epidemic with the statement that the people of the "Punjab have been dying from it for some time past "at the rate of 50,000 a week gives but a faint idea "of the deserted villages, the crops rotting upon the "ground over wide areas for lack of men to reap "them, and the breaking-up of homes and family life "inseparable from such a calamity." And again, "Natives of Rawul Pindi who have relations in the "plague-infected villages will not go to tend their "sick; others have left the corpses or belongings "of deceased relatives to the mercy of the village "rather than risk plague. Firewood is not obtain-"able to burn the dead, so timber from the houses is "being utilised, and many Hindoos are burying "their dead." Professor Simpson well remarks: "The silence of those unharvested fields, together "with the figures of mortality, should bring to "everyone's imagination a very clear realisation of "the awful devastation of the Punjab. . . . The "dying millions in India present a problem of the "greatest urgency and danger. The plague if left, "as it has been within recent years, to take its own "course, bids fair in such circumstances to over-"whelm not only India, but also to be a danger to "the world."

NATURE OF PLAGUE.

What is the nature of this terrible affection? Plague is a specific infectious disease caused by an organism which was discovered by the Japanese savant, Dr. Kitasato, in 1894. It bears much resemblance to cases of typhus complicated with parotid buboes, so much so that, as Murchison narrates, the celebrated Egyptian physician Clot Bey, on visiting the London Fever Hospital some years ago, declared that the above cases would be regarded in Egypt as examples of the disease. How does this bacillus gain access to man? The paths of infection are now pretty well established. It has been determined that the disease is imported into healthy localities by infected *rats*, infected *grain* and *food*, infected *clothes*, and by *human agency*.

1. *Infected Rats.*—Rats are held to be one of the principal agents concerned in the spread of the disease. Professor W. Simpson was the first to attach importance to this fact and to act practically against it. He destroyed rats to prevent plague in 1897 in Calcutta, and subsequently at Cape Town and Hong Kong showed these rodents to be incriminated. The rat conveys plague in three ways: (i.) *By the rat flea.* The flea, leaving the rat dead from plague, infects man by biting him. It has been often observed that rats dead only a few hours are more dangerous than those which have been dead some time and are quite cold; the reason of this is that on the latter the fleas have left the animal. Captain Liston, I.M.S., established the fact of the capability of infected rats conveying the disease to rats not infected. Dr. Simpson also infected monkeys by rats who had died from plague, by placing the latter in compartments, preventing any possible contact between rat and monkey, but allowing the free passage of fleas from rat to monkey. Again, the outbreak of plague

in any given locality has been over and over again preceded by a mortality among the rats, whilst an anti-rat campaign in stations has been fruitful of good results. Take the case of Bangalore, for instance. Measures against rats were started in June 1906; up to January 1907, 139,290 rats had been killed, and the latest return of plague seizures and deaths in this station is *nil*, and this at a time when plague in Bangalore is usually at its worst. Simpson gives also a striking instance. In 1896 certain cases of plague occurred in Calcutta, and the rats in a certain grain depôt began to die. It was determined to stamp out the rat plague. For this purpose the floors were taken up, the rats were killed, and the floors and runs flooded with crude carbolic acid, with the result that the epidemic among the rats, whose mortality had mounted up to 100 a day, was arrested. Similar treatment was adopted in some adjacent houses to which rats had migrated. *No cases of plague occurred in that locality.*

(ii.) *By Infected Food.*—This flea theory, however, will not, as Simpson shows, account for more than a certain percentage of the fatal bubonic cases; he instances the fact that although fleas are commonly found on infants, yet the incidence of plague on infants is very small. He is therefore in favour of the infection being largely contracted by the alimentary canal, the food being contaminated by the rat *by its saliva, fæcal excreta, or urine.* Simpson made a series of feeding experiments in which poultry, calves, pigs, sheep, rats, and a monkey contracted the disease in this way. Dr. Klein has also shown that the plague bacilli taken in contaminated food multiply whilst the food is in the intestine, enter through the lymphatic system, and so invade the blood. Rats can also convey plague (iii.) *by the bacilli inoculating any abrasion on the foot or hand.* To show the influence of rats in the spread of plague,

a good example is furnished by the Punjab. Here in six months of 1907 the deaths were at the rate of one in forty over the whole province, and one in twenty in large towns like Delhi. But living in the midst of this plague-stricken people are 55,000 railway employés with their families. These people dwell in masonry rooms or cubicles with concrete floors and roofs; such quarters are rat proof, except the doors, which are closed at night. The plague death rate here is only one in 1,000 per annum.

2. *Infected Clothes.*—Several instances are on record showing this means of infection. Simpson instances the case of a sweeper in an infected village in the Punjab who worked in the house of a man who died from plague. He received as a present some of the patient's clothes, which he took home to his non-infected village, and of which he gave some to a neighbour. The neighbour was attacked with plague shortly afterwards.

3. *Human Agency.*—Captain James, I.M.S., inquiring into the source of importation, found that out of 63 villages, no less than 47, or 73 per cent. were infected by the arrival of infected persons. Captain Browning Smith, I.M.S., in his report on "Plague and Inoculation Experiments," states that the usual method of spread from village to village is by human intercourse between healthy and infected villages. The sick convey the disease in various ways—*e.g.*, by the sputum in pneumonic cases; whilst plague bacilli have been found in the urine and fæces. Again, if an individual walk with bare feet on which may be some slight abrasion on a floor on which a patient with plague has lain, he can be infected. The Chinese, who walk barefooted, usually get the inguinal glands first affected; whilst the Japanese, who wear shoes, have the axillary glands sooner involved. Some observers also maintain that the bacillus can pass through healthy skin. Kitasato

has also shown that the bacilli persist in the blood three or four weeks after the onset of the disease, so that convalescents may unwittingly spread the disease.

SYMPTOMS.

There are three principal varieties of plague—namely, (1) the *bubonic*; (2) the *pneumonic*; (3) the *septicæmic*. Besides these types there are minor manifestations of the disease which I will first describe, but, before doing so, it should be stated that one of the first signs that plague is about to break out in any given community is a great mortality amongst the rats of the locality. As an instance, Weir noticed this in Bombay in many of the houses.

The Incubation Period in man is usually from a few hours to five days, but may be ten. And now as to the mild forms of the attack: the first cases may assume the condition of *Pestis minor*. Here chronic buboes without any venereal origin are seen, accompanied by a fever of a remittent type. The glands in the groin enlarge, and within a fortnight suppurate. In cases of this kind occurring in Calcutta, Simpson, on examination of the glands, found therein the plague bacillus. Another mild form is the *Pestis Ambulans*, in which the patient feels so little ill that he does not lie up; a gland or glands enlarge, subside or suppurate, and the plague bacillus is found on examination.

With regard to the three major varieties of the affection, there are certain symptoms common to all of them. The attack usually begins abruptly, but not always so, sometimes there may be before the onset of marked symptoms a short period of malaise. The invasion sets in with chilliness, less frequently with a rigor. The features are drawn and haggard, or like those of an intoxicated individual; the eyes are often infected; the appearance of the tongue

is characteristic, being swollen and indented, with a creamy white fur showing the red papillæ through it, the tips and edges being red. Later on the coating becomes dry and with a mother-of-pearl appearance, and still later it presents a reddish brown or yellowish crust. The lips are covered with sordes. The patient will also show a staggering gait and in-co-ordination of the hands. The speech is peculiarly hesitating, often like that of a drunken man, while his mental state is confused.

Such are the symptoms met with at the beginning of each of the above varieties. In the *bubonic type* the glands now become painful and inflamed, together with inflammation of the peri-glandular tissue. With regard to the temperature, this is high during the first two days, dropping then to near the normal, and becoming high again on the fifth and sixth days, when it will remain fairly high for a while till it gradually attains the normal. The prostration is not so extreme as in the other varieties, whilst the mortality is lower also. In the *pneumonic* type, discovered by Major Childs, I.M.S., we have the most virulent form. Here we as a rule find no glandular enlargement, but the lung symptoms play the chief part; the temperature rises considerably at the beginning, and remains so till the end, or there may be a sudden crisis just before death; the sputum is frothy and tinged with blood, but has not the usual rusty viscid appearance of ordinary pneumonia before described. The mortality is very great, few recovering; death usually occurs from the third to the fifth day. In the last variety, the *septicæmic*, the glands are found to be merely enlarged, without any periglandular inflammation; the temperature rises considerably at the actual commencement, remaining high until the end; in the *fulminant* cases of this variety Cantlie says the temperature may rise scarcely above the normal, the prostration also is extreme.

The mortality here again is high, but few recovering, and death occurring in from one to five days. Such are a few of the symptoms of plague. For their description I am indebted to the writings of two of our greatest authorities on the disease—namely, Mr. Cantlie and Professor Simpson—as I have had no personal experience of this affection.

A. PREVENTIVE MEASURES.

1. *The Precautions to be Undertaken by the Nurse.*—The nurse attending a plague patient will, of course, observe all the general rules for keeping herself in good health: she should always disinfect her hands, never eat her meals in the sick-room, and have regular hours daily for out-door recreation. She should also have been inoculated previously to the attendance. There can be not the slightest doubt of the benefit accruing to this practice of preventive inoculation for plague. To Professor Haffkine, who discovered and practised the valuable prophylactic inoculation for cholera, we are again indebted for a like measure as regards plague. He first tried it at the Byculla House of Correction in Bombay in 1897, and found that one injection was sufficient to protect during an existing epidemic; while, though powerless to arrest the disease where the symptoms had already appeared, or which develop within a few hours, yet that it will mitigate or abort it in the very early stages, and that it exercises its protective powers in less than twenty-four hours. Simpson holds inoculation to be "the "most powerful measure against a prevailing epi-"demic of plague" that can be employed in India, and that as a protective measure it deserves to be in the first rank. An example of the beneficial influence attending this preventive measure is cited by the latter authority. In a certain year, of 224,428 inoculated individuals, the average numbe

exposed throughout the epidemic was 186,797 ; whilst the average uninoculated, with whom the inoculated were living in the same village, was 639,630. Now these 639,630 non-inoculated persons had 29,723 deaths from plague. The 186,797 inoculated persons should have had proportionately 8,680 deaths ; but, owing to the preventive inoculation, instead of 8,680 deaths, they only had 814. "This prevention of "7,866 calculated possible deaths out of 8,680, or "90.62 per cent., may be fairly attributed to the "effect of the inoculation—*i.e.* 7,866 lives out of "8,680, or 90.62 per cent., were saved by inocula-"tion." Numerous other instances might be cited of the value of this procedure, but the above will suffice.

But, like all other procedures tending to benefit mankind, this has had to withstand and triumph over objection. It was urged that the prophylactic, instead of mitigating the disease in the incubation stage, as was maintained by Haffkine, increased the risk of death. The Indian Plague Commission and the Oporto Commission especially controverted Haffkine's view ; the first holding that inoculation was unlikely to exert any favourable influence on persons already incubating plague ; whilst the second went so far as to state that the prophylactic was only of avail after eight to ten days had elapsed, but that before this the virulence of the disease was increased, rendering death more certain. It was stated, in fact, that until the immunity was established, the organism during the eight or ten days was more sensitive to infection. Now this objection, if valid, would be such that it would be impossible to apply the prophylactic during an epidemic. But Simpson has fully exposed its erroneous assumptions—for he has shown convincingly that, so far from there being increased danger for eight to ten days after inoculation should the person inoculated be exposed to infection during

that period, or be incubating plague at the time of inoculation, the contrary is the case. There is a considerable protective effect on the second day after inoculation, and the relative immunity continues over four months, whilst he considers that probably further observation will demonstrate this immunity to be effective for about two years.

The nurse, then, having been inoculated, will experience three or four hours afterwards, some inconveniences—such as headache, malaise, fever, and slight pain at the seat of inoculation for about forty-eight hours; during this time she should rest and abstain from all work, keeping her arm in a sling to ensure perfect rest, and bathing it with a little hot water or lead and opium lotion. The diet should be light, and a purgative taken on the first day.

Native nurses should be cautioned not to wipe away any discharges from the patient with their hands or clothes.

2. *General Preventive Measures.*—The eradication of plague from India presents a difficulty of the greatest magnitude, owing to the habits of the people, their dislike to removal to plague camps, or the childish suspicions entertained by them with regard to the good intentions of the plague officers. Theoretically, a plague patient should be at once removed to a plague camp; but in the East this cannot be carried out as a matter of course; where it is insisted on, the only effect may be that the cases will be hidden and not reported. This difficulty of removal has been met with in many cases by inoculating all the other inmates of the house; but again, this beneficent measure may be refused; whilst the unfortunate Mulkowal incident, for which Prof. Haffkine was at first most unjustly and unwarrantably blamed, prejudiced for a time this method of prevention. The measures for the subdual of this virulent disease, as shown by Professor Simpson,

however, lie in the general systematic inoculation of the inmates of any house in which plague has occurred; and in the evacuation of an infected locality. "Evacuation of an infected locality and "inoculation promptly carried out will stop any epi-"demic." A striking example is narrated by this authority that occurred in Cape Town, where plague was becoming serious amongst the Kaffirs. It having been decided to remove them from their unsanitary dwellings, some 7,000 to 8,000 were so removed and all were inoculated. The epidemic at once ceased among them. With regard to the treatment of the plague-stricken domicile, Simpson strongly recommends its disinfection by sulphurous acid gas by means of the Clayton method. This will destroy not only the plague germ, but also rats, fleas, bugs, and other agents capable of conveying the infection, and, moreover, does away with the irritating procedure of removing all the different effects of the natives for disinfection elsewhere, as everything is thus dealt with *in situ*. The efficacy of sulphurous acid gas as a disinfectant was amply demonstrated some years ago by Dr. Evan Buchanan Baxter, of King's College Hospital, whose comparatively early death was so great a loss to medical science. Simpson points out the small amount of disturbance necessary in this procedure; the only articles requiring removal during the period the disinfection is carried on being foodstuffs such as flour, fresh fruit, fish, and meat. Any articles liable to become tarnished by the process can be protected by covering them with cloths, which at the same time does not prevent their being rendered harmless for conveying the infection.

B. The Actual Nursing of a Case.

With regard to the different clinical varieties of the disease, those of the pneumonic type are

especially infective. Not a few instances now are on record of both doctors and nurses having been attacked by this form of plague. A sad example of this was illustrated by the deaths of Surgeon-Major Manser, I.M.S., and of the nurse who attended him at Bombay. The nurse must, in attending to this class of the disease, be especially careful to disinfect the sputum. The other two varieties are less obnoxious in this respect. But in all the cases the urine and discharge from the bowels must be disinfected; especially is this the case with regard to the septicæmic variety. The disinfection of the excreta must also be carried out religiously during the convalescence of the patient, for the plague organism has been found in the fæces of the patient a month after the cessation of the attack. The clothes of the patient must be disinfected, and preferably destroyed by burning.

In laying out the dead, the nurse must be careful not to become infected by any of the discharges from the patient, as the disease has been known to have been conveyed to undertakers in this fashion.

Lastly, always remember to burn all dead rats found in the house of the sick.

CHAPTER XI.

BERI-BERI.

This is a disease for which there are not very many special indications for nursing; but there is one feature in its course which it is important the nurse should be cognisant of, and therefore the general characteristics of the disease will be described. Many cases are now yearly admitted into the Seamen's Hospital; but it is a curious fact that thirty years ago the disease was never seen there. It first appeared, in fact, in the Medical Returns about the year 1885. The reason of this is not very easily explained. Some would say the disease, as such, was not diagnosed. This I cannot believe for a moment, considering that the physicians at that time were the late Drs. Stephen Ward and Charles Henry Ralfe, both men of distinguished clinical acumen, who might, perhaps, have mistaken their first case, but would not be likely to do so a second time. No one could or ought to mistake it for locomotor ataxy, as, beyond the loss of patellar reflex, there is no resemblance between the two diseases.

Nature of the Disease.

Beri-beri is met with in most of the tropical and sub-tropical regions, although while serving in the Punjab and United Provinces of India I never saw a case, or any case of disease at all like it. It has also occurred in temperate climates, as in France

and in the Richmond Asylum, Dublin. It may be defined as a specific endemic or epidemic multiple peripheral neuritis. The mortality is large, and *the chief danger to be apprehended is death from cardiac paralysis.*

THEORIES OF ITS CAUSATION.

The exact etiology is not yet determined. Various theories have been brought forward concerning it. Thus, to mention first some that are certainly erroneous. *Malaria*, of course, has been advocated, as is the case with so many diseases that baffle investigation. Again, *scurvy* has been cited. And, again, it has been held by some authorities of standing that the beri-beric neuritis is but an *arsenical neuritis.* Coming now to the theories concerning which there is more truth, we may broadly classify them into the theory connecting the disease with a living organism, and the theory connecting it with some condition of the diet.

A. *The Theories Connected with Living Organisms.*—(1) *Intestinal Worm Theory*: The late Dr. Kynsey, Inspector-General of Civil Hospitals, Ceylon, held that one form of the disease was due to the presence of the ankylostoma, and possibly of the tricocephalus dispar, causing anæmia. This however, has not much to recommend it. (2) *Germ Theories.* Pekelhäring and Winkler claim to have discovered a special organism. Again, Dangerfield has described a bacterium which passes through the various stages of a hemispherical, a diplococcic, a micrococcic, a zoogloœic, and a sporulating form. Sir Patrick Manson believes the disease to be produced by the toxin from a germ whose seat is outside the body; he compares the case to one of alcoholism. Here the germ is the yeast-plant, the nidus the solution of sugar, the toxin the alcohol, and the pathological effect the peripheral neuritis.

In beri-beri there is the germ, the nidus the soil, house, or ship; here it proliferates the toxin, with its pathological effect the neuritis. A case in favour of this theory occurred at Kuala Lumpor, in the New or Pudoh Gaol. This was occupied in January 1895, the old gaol being vacated at the same time. For many years the latter had had no cases of beri-beri. In August the disease broke out in the Pudoh Gaol. There was a case mortality in September of 31.7 per cent. The authorities, knowing the salubrity of the old gaol, retransferred the cases to it, and the mortality immediately began to fall; by December it was only 4.25 per cent.

Having reached the body, where does this toxin begin to act? Some say, as Durham, in the throat: others in the blood: or in the contents of the intestinal canal; or, as Hamilton Wright holds, in his most recent view of the subject, in the gastro-intestinal mucous membrane. This observer, like Dr. Norman Chevers, considers the neuritis of beri-beri, arising in the lesion of the gastro-duodenum, to be analogous to the neuritis of diphtheria arising from the lesion of the throat.

B. *Dietetic Theories.*—(1) *Deficiency in Nitrogen*: In the Japanese Navy formerly beri-beri raged. Then, in 1882, 30 to 40 per cent. of the sickness was due to this disease; the diet was then exclusively rice. In 1884 an improved dietary was instituted, and the mortality at once fell to 12.44 per cent. In 1885 the diet was still further improved, and the death-rate then became only 0.59 per cent. With regard to the causation by rice, it was found in the Javan prisons that whereas in those prisons where white rice was given 36 out of 51 were affected, in those in which red uncleaned rice was the diet only one out of 37 gaols were attacked. Vordermann also reports that on another occasion in the Javan prisons those using red rice entirely escaped, while those eating white rice suffered severely. The

reason of this difference is not altogether clear. It can hardly be due to the slightly larger percentage of nitrogen in the red rice. (2) *Deficiency in Fat*: Brémaud thinks that a deficiency of fat is the cause, founding his belief on the fact that an epidemic at Poulo Condor ceased suddenly under the influence of a regimen containing fat pork.

An objection to the theory of an improved dietary being the cause of the diminution of the disease has been the following—namely, that in addition to the improved dietary there has been also an improved hygienic state generally. This objection will, however, not hold water in the following striking instance exhibited by an experience in the Japanese navy. Dr. Takaki, Surgeon-General of the Imperial navy, acting on the view that beri-beri arose from an improper or insufficient dietary, has completely eliminated the affection from that branch of the military service. In 1880, when he was Deputy Medical Inspector-General, he noticed the great disproportion between the number of cases occurring on warships and those in barracks, and thought that the difference might be due to the difference between the food supplied aboard ships and that supplied ashore. Analysing the naval dietary, he concluded that the proportion of carbohydrates in the food was in excess of the requirements, and that the proteids were deficient. In 1882 he became Vice Medical Director of the Navy, and shortly after drew up a memorial in regard to preventive measures. Previous to 1881 the number of cases of beri-beri in the navy was about three-fourths of the entire cases of illness. In 1882 there was a prospect of a war with Korea, and it was found that the crews of five of the largest ships of war of the Japanese navy were prostrated with the disease, and it was rather doubtful if the navy would be of any use should war break out. In 1883 a crucial case occurred. The Japanese warship *Ryujo* made a

voyage of 271 days to New Zealand and South America, stopping at Wellington, Valparaiso, Callao, and Honolulu. The *Ryujo* had 160 cases of beri-beri out of 350 persons on board. Dr. Takaki now determined to send another ship over precisely the same course and under the same conditions. The *Taukuba* therefore sailed, the only difference being that it had a new diet scale, avoiding the excessive use of rice. The result was as follows: —

Ryujo ... 271 days' voyage, 160 cases of beri-beri.
Taukuba ... 287 days' voyage, 16 cases of beri-beri.

This favourable result of an improved dietary showed its efficacy, and, the improved diet being continued, *the navy during the war with Russia was entirely free from the disease.* The old diet contained: —

Carbohydrates	622.32 grams.
Fat	15.8 grams.
Proteids	109.29 grams.

The improved diet contained: —

Carbohydrates	775 grams.
Fat	43 grams.
Proteids	196 grams.

One additional series of figures may be given showing the result in the changes of the navy in the record of beri-beri after this improved diet: —

The Old Diet from 1878 *to* 1883.

1878...	ratio of beri-beri per 100 of force	32.80
1879...	,, ,, ,,	38.93
1880...	,, ,, ,,	34.81
1881...	,, ,, ,,	25.06
1882...	,, ,, ,,	40.45
1883...	,, ,, ,,	23.12

The New Diet for 1884 *to* 1889.

1884...	ratio of beri-beri per 100 of force	12.44
1885...	,, ,, ,,	0.59
1886...	,, ,, ,,	0.04
1887...	,, ,, ,,	0.00
1888...	,, ,, ,,	0.00
1889...	,, ,, ,,	0.03

This shows that about one-third of the entire navy had suffered from the disease in the first, and about one sixty-third during the second period. Since 1900 there have not been a dozen cases in the navy, notwithstanding the enormous increase in its strength. In the Japanese army during the war, where the improved diet scale was not in vogue, about one-half of the sickness was due to beri-beri; 24.3 per cent. of the *personnel*, or 84,545 men being affected, although the men in the field would probably breathe more unvitiated air than the men in the ships, while no case appeared in the floating force of the navy of over 25,000 men.

Thus both the germ theory and the dietetic theory have well-established facts to support them, but I think there can be no doubt that the disease is connected—in some way, at any rate—with the nature of the diet.

SYMPTOMS.

The disease has been variously classified by different authorities. Thus Scheube groups the cases into: —

1. The incomplete, chronic relapsing, imperfect, or rudimentary.
2. The dry or atrophic.
3. The wet or œdematous.
4. The acute pernicious fulminating.

Hamilton Wright describes: —

1. The acute pernicious.
2. The acute.
3. The subacute.
4. The class of beri-beric residual paralysis.

The two forms that are of especial interest for the nurse are, however, (1) the acute fulminating pernicious form, (2) the acute form, as in these two classes the especial danger to be looked for and pro-

vided against is *the involvement of the heart.* In the subacute class the paralytic symptoms do not notably affect the heart as a rule, although in nearly all the cases there is some heart trouble, and, indeed, it has been noted that the mildest cases may be in reality full of danger as regards prognosis. The disease, as shown by the definition, is a neuritis, and the great danger to the patient is that arising from implication of the pneumogastric nerve and the cardiac plexus. The second source of danger is from *œdema of the lungs.*

The chief symptoms that will be noted by the nurse may be stated to be the following, irrespective of the various forms detailed above: The patient presents certain *initial* symptoms, such as depression of spirits, incapability for work, insomnia, and a feeling of impending trouble. Dyspnœa, cramps in the legs, and some puffiness of the face and legs may be noticed. In many cases there is a peculiar cachectic appearance. These symptoms may subside for a week or a few months, after which the disease will show itself in its fully developing form. Hamilton Wright lays stress on the loss of appetite, epigastric pain and discomfort as the early symptoms, and says that those who die in this early stage always show vascular injection, with hæmorrhages and swelling of the intestinal mucosa of the duodenum at the autopsy. The patient, as the disease becomes more manifest, now complains of weakness and a dragging pain in the legs; there is pain felt on squeezing the calves, whilst over the front of the tibia œdema becomes marked, and sensation is numbed. Wernick draws attention to an area about the ankles where slight impressions are not marked. A painful constriction in the epigastrium may be likewise complained of. The symptoms that next ensue may be described as follows: —

1. *Motor.—The weakness* of the legs becomes

greater: the paresis travels upwards to the upper extremities, finally affecting the muscles of the abdomen and thorax. Palsy of the larynx has been reported as causing sudden death. Complete motor palsy is rare; should recovery ensue, power is regained first in the thorax and abdomen, then in the upper, and last of all in the lower, extremities. There are also two well-marked signs present—namely, the *high-stepping gait*; this is due to the ankle drop, so that the patient drags his toes when he advances his foot in progression, and accordingly he raises his foot very high in order to clear the ground, letting it fall with a flop on the ground; the second sign is that *the patient has difficulty in standing on one leg with his eyes shut.*

2. *Sensory.*—There is symmetrical *numbness*, extending from the legs to the feet, then to the thighs; and it may affect the hands and fingers, and occasionally the chest and abdomen. Pekelharing states that the groins are spared. The sense of *heat* is diminished, while the sense of *pain* is lessened more gradually. The disorders of cutaneous sensibility occur in an irregular manner; thus there may be zones of absence of, or of excessive, sensibility, or of tingling, pricking of "pins and needles," or of formication and numbness.

3. *Reflexes.*—At the beginning the cutaneous and tendinous reflexes are exaggerated; the deep reflexes then disappear. The knee reflex is said to be invariably absent, but in one of my cases at the hospital it was noted to be continuously in excess.

4. *Œdema.*—This can nearly always be found at the beginning over the tibia and the sacrum; it may only be observed here and in the face. It is a hard elastic œdema, and generally persists to the end, and may spread to the body generally, invading the lungs and serous cavities. In the genitals it is slight. Occasionally, instead of being symmetrical, it has been noticed to be one-sided or crossed.

5. *The Skin* is dry, although occasionally sweating, and it may show a roseolar or erythematous rash.

6. *The Lungs* may be involved, the patient being dyspnœic from these organs becoming œdematous, and often this œdematous condition is acute.

7. *The Urinary System.*—The act of micturition may be difficult or painful, but is otherwise unaffected. The urine is often diminished in quantity; it is acid; it may be albuminous or the reverse.

8. *The Heart.*—I have left the *condition due to the heart* to the last, as it is the most important as regards the patient, and is the condition that behoves the nurse to take especial notice of. She must be always on the look-out for *symptoms that indicate grave heart complications*, and amongst these the following are important: increased excitability and palpitation, great dyspnœa and pain felt beneath the sternum, the pulsation of the large vessels of the neck, pulsation in the epigastrium, and a feeble pulse at the wrist. Should these arise, the attention of the physician must be at once called to the patient.

Such are the general features of the cases. The patients are, as stated above, also divided into the atrophic or paralytic and the dropsical cases. The contrast exhibited by these two classes is very striking; in the former the paretic symptoms and the muscular wasting are most marked, and any œdema present is slight; in the latter the dropsy is most pronounced. Lastly, it may be mentioned that these two forms often change one into the other, the atrophic becoming œdematous and *vice versâ*.

MORTALITY.

This varies in different places and epidemics; generally it may be said to be from 30 per cent. to 5 per cent., or less. It is higher in the dropsical than

in the paralytic cases, and is especially high in the acute pernicious form.

TREATMENT.

The nurse must bear in mind that the two chief causes of death are *due to the involvement of the heart* and *to œdema of the lungs*. As these cardiac symptoms often develop very suddenly, there may be no time to acquaint the medical officer in charge of the case, and the nurse, having been fully made acquainted with the symptoms of cardiac involvement, should give the patient inhalations of nitrite of amyl, or from three to five drops of a 1 per cent. solution of nitro-glycerine, repeated every half-hour or more frequently, until the patient is relieved; of course, she will have previously obtained the permission of the physician so to act. The inhalation of nitrite of amyl will be indicated in the more urgent cases. These drugs should always be kept handy near the patient. The inhalation of oxygen, if the necessary apparatus be at hand, may also be tried. The nurse must never allow the patient to exert himself, or sit up in bed, until the physician permits of such actions.

Bedsores may occur, and the rules for their prevention and treatment, already previously stated, are to be followed out. Cramps of the limbs when present call for friction with anodyne liniments and change of posture.

As regards *food*, the nitrogenous elements must be fully represented in the diet. Oatmeal and beans are very suitable, whilst milk and eggs may also be given.

Besides such measures, the chief proceeding is to remove the patient from the locality in which he has contracted the disease. An example of the good effect produced by this measure may be quoted. In Bahia, before removal, the mortality was 74.5 per cent.; after removal of the patients to Rio Janeiro

the mortality was reduced to 13.5 per cent.; the disease then became endemic in the latter place, and the mortality rose to 25.30 per cent. They were then removed to Nova Friburg, when it sank to 2 per cent. Should removal not be possible, the patient must be taken to a well-ventilated house and be fed well.

Lastly, for the atrophy and anæsthesia, the nurse will, under the direction of the medical attendant, apply Faradic electricity and massage to the affected parts. These are recommended to be given as soon as the muscular hyperæsthesia has begun to diminish.

For the Prophylaxis of the disease, all we can do in any outbreak is to remove the inhabitants to a healthy non-endemic locality, disinfect the affected buildings, drain any damp soil, and feed the people well.

CHAPTER XII.

TROPICAL LIVER.

UNDER the term "tropical liver" we mean to express those states of congestion of the liver that occur in tropical climates.

ETIOLOGY.

It is especially a malady of recent arrivals in its acute form; in older residents it occurs more gradually. Females are less subject to it than males; whilst in children it is uncommon. The main conditions affecting the quantity of blood in the liver are connected with the *digestive system*. Normally during the process of digestion there is daily an increased flow of blood through the organs concerned. But the *respiratory system* also plays its part, in this way: the blood-pressure in the portal vein exceeds that in the hepatic, thus enabling the blood to pass from the portal to the hepatic vein. Now, during the act of respiration the abdominal pressure rises, whilst the intra-thoracic falls, and the diaphragm, in its descent, presses on the liver, facilitating thus the flow of blood through it. We thus see how exercise furthers this flow of blood, whilst sedentary habits retard it, since the diaphragm will act more vigorously during exercise.

Amongst the more immediate factors in the causation are the following: —

1. *Cold Bathing.*—Few people in the tropics can continue to take cold baths—in fact, I personally have only known one officer who has done so during my service in India. Some time after I had arrived in India I began to feel a pain at the top of my right chest on any exertion, for which, on its becoming progressively more acute, I consulted a brother medical officer. The first question he asked me was whether I still took cold baths, and, on my replying in the affirmative, he advised their discontinuance. The symptom ceased as soon as hot water was added to the daily tub.

2. *Chills after Exercise* are a fruitful cause of the affection.

3. *Gastric Catarrh set up by Over-indulgence in Drink and Meat* are fertile excitants of the malady. Professor Maclean, at Netley, always advised us to take meat only once in the twenty-four hours in the tropics, and held that it was of equal importance to restrict the solid as to do the same to the liquid elements of the food.

4. *Malaria and Dysentery.*—Drs. Kelsch and Kiener state that nearly all cases of congestion of the liver in warm climates can be traced back to malaria and dysentery. This statement, however, is too sweeping.

Symptoms.

Usually the first symptom is uneasiness or pain in the right hypochondrium or right shoulder, felt especially on making any exertion, and increased by deep inspiration or by lying on the left side, or by pressure. The reason that uneasiness is felt on lying on the left side is because by this position the liver hangs over from the right to the left. Tenderness may be also felt about three inches directly below the apex of the inferior angle of the scapula. The patient says his liver is as heavy as lead; it can often be felt below the costal

margin for an inch or more. With the above symptoms the patient also has a general feeling of discomfort, headache, loss of appetite, bitter taste in the mouth, coated tongue, and constipation or diarrhœa. The motions are pale and whitish in colour. The conjunctivæ may be more or less jaundiced. He becomes depressed and melancholy, and loses all desire for exercise. Sleep is unrefreshing, and on rising in the morning there is oppressive aching in the whole body and limbs. The patient often has a constant feeling of nausea, or may vomit, and it has been found in many cases that both nausea and vomiting may be brought on by the use of the toothbrush—indeed, these latter may be the first symptoms of the affection. Lastly, the sufferer is the possessor of a very irritable temper.

TREATMENT.

1. *Preventive.*—Everyone in the tropics must take daily a certain amount of exercise. An excellent prophylactic, and one of the best, is the early morning ride. After exercise of whatever form, one must be careful not to take a chill. Cold baths must be avoided, the water always being warm. There must be no excess in eating or drinking, and the food should be non-stimulating from spices, etc.

2. *In the Actual Nursing of a Case.*—The diet must be of the lightest, consisting of milk and soda or weak cocoa, toast, soft boiled eggs, light milk puddings, and soup. No alcohol should be taken. The nurse may apply also counter irritation to the region of the liver by turpentine stupes. The drugs indicated will, of course, be given as ordered by the doctor, and here I may mention that Professor Maclean held that scruple doses of ipecacuanha were as useful in this affection as in dysentery.

Nitro-Muriatic Acid Bath.—Sir Ranald Martin advocated the use of the nitro-muriatic acid bath,

so that it may be pointed out to the nurse how this is given. Two ounces of strong hydrochloric acid with one ounce of strong nitric acid are added to two gallons of water at a temperature of 96° or 98° F. Both feet are placed in the bath, whilst the inside of the legs and thighs, the right side over the liver, and the inside of both arms are sponged alternately, or the abdomen may be swathed in flannel soaked in this liquid. The process should be carried out for half an hour night and morning. The bath, as above prepared, may be kept in use for a few days by adding one drachm of the hydrochloric and half a drachm of the nitric acid with a pint of water to the original quantity to make up for the wastage. Glazed earthenware or wooden vessels must be used, and the towels and sponges kept constantly in cold water to prevent any corrosion by the acids.

Treatment by the Hydropathic Belt.—This method of treating has been found very successful by Major L. Tarleton Young, I.M.S., in chronic tropical liver. As advocated by this authority it consists of a piece of swansdown calico about 4 feet by 1 foot, wetted in tepid water and applied next the skin around the waist. Over this you place mackintosh to prevent evaporation, and over both a flannel roll wound several times round the waist. The swansdown is removed twice or thrice daily, scalded, and reapplied. In a week or ten days under this treatment the skin breaks down and the entire waist becomes red and raw. The bandage, however, is continued as before, and after a time complete healing results. It is remarkable that the sore heals up under the same treatment that produced it.

Treatment by a Carlsbad Course.—There is no need to extol the Carlsbad course for tropical liver. But it is not everyone that can afford either the money or can get leave to attend it. Major Tarleton Young has shown us how, at a most trifling cost, it

can be imitated and carried out without proceeding to Carlsbad. This may be accomplished by one of two methods.

First Method: With the Natural Imported Water.—One dozen bottles of the imported natural Carlsbad water (Sprudel) are procured. Six ounces by measure of the water are poured into a small beer tumbler of thin glass, which is then placed in a vessel of hot water until it is warmed to the required temperature. To save time in the future, a mark should be scratched on the outside of the tumbler so that the exact amount to be poured in on subsequent occasions may be known. This six-ounce dose is drunk fasting the first thing in the morning, after which a quiet twenty minutes' stroll is taken; then drink another six-ounce dose and take another twenty minutes' stroll; and finally take a third six-ounce dose, after which you take an hour's good walk before breakfast. The latter must not be taken until at least an hour after the last dose. The last two doses should be awaiting the patient, ready warmed for him, on his return from his first walk, so that no time is lost in warming them up.

Another but not so efficacious method is to take the three doses whilst you are dressing.

Second Method: With the Natural Powdery Form of the Carlsbad Salts.—The chemist weighs out a bottle of these salts into packets, each containing 53 grains. Put one in a tall tumbler of very thin glass capable of holding one pint. On it pour 15 ounces of boiling water, which will not crack the thin glass. The powder dissolves, forming a perfectly clear solution. Let it cool somewhat, and then add from a syphon about 5 ounces of soda-water. Mix the latter thoroughly with the salt solution. Then pour off 6 ounces of it, and drink it and the two subsequent doses as in the first method, allowing twenty minutes' interval between each.

The dose is never to be taken in one draught,

but sipped slowly, two or three minutes being spent in drinking it. The three doses should have a slightly aperient effect; if they have not, then one or two extra 53-grain powders should be added till the desired effect is produced. It is found that the colder the water, the greater the aperient effect. Hence during the first week of the course give the water as cool as possible, during the second week give it warm, and during the third week hot; that is to say, during the first week the temperature of the water drunk should be about 70° F. or else quite cold, during the second week about 98° F., and about 120° F. during the third week. In places where the Carlsbad salts cannot be obtained, Manson says an efficient substitute is composed of:—

Sulphate of soda	1 part
Bicarbonate of soda	2 parts
Chloride of sodium	1 part

Diet during this Course.—Whilst pursuing this regimen the following diet should be taken: At 9 A.M. two soft-boiled eggs, three or four pieces of dry toast, no butter, with one or two cups of tea; at noon a small quantity of meat or chicken with some light pudding or fruit stew. Supper is similar to breakfast. After breakfast or lunch a short walk may be taken.

CHAPTER XIII.

BLACKWATER FEVER.

THE nurse who is engaged in her duties in various parts of Africa will be sure to meet with blackwater fever. Thus it is found on the west and the east coasts of that continent, also in British and German East Africa, in Uganda, and in Rhodesia, amongst other regions. In India I never came across a case, but it has recently been described in that country, having been found in Assam, Meerut, Umritsar, and Darjeeling. The disease is characterised by an enormous destruction of the red blood corpuscles, and its prominent symptoms are fever accompanied by rigor, serious vomiting, jaundice, and hæmoglobinuria—the blackwater.

CAUSATION.

This cannot be stated to be definitely settled—various views have been held concerning it. Amongst the *predisposing causes* may be mentioned first of all a debilitated constitution from previous illness, such as malaria or dysentery. Sex and age have no influence, adults are chiefly attacked on account of their greater exposure. Race is not an important factor, for the so-called immunity of natives is simply due to the immunity derived from a long period of residence in the endemic districts. It has been well pointed out that natives of the same tribe, but not living in the endemic district, will contract it on entering that district. With reference to this

Plehn draws attention to an outbreak occurring amongst the natives in the Cameroons, those who had come to the coast from the interior having been especially attacked.

Exciting Causes.

1. In Sicily and Sardinia the opinion is held by many of the inhabitants that the affection is due to the eating of *fresh broad beans*, owing to the fact of the fever being rife at the time of the ripening of these vegetables. But broad beans are eaten everywhere without blackwater fever occurring, and the latter also occurs where they have not been eaten.

2. *Malaria* is held by others to present as one of its manfestations blackwater fever, the latter being due to a very intense form of the affection; or, according to Dr. Prout, one of the acknowledged authorities on the disease, this affection is due to a special condition of the blood produced by repeated attacks of malaria, whereby the vitality of the red blood cells is lowered, and so the connection between the hæmoglobin and stroma is weakened. Then some sudden exciting cause will produce the affection—such as a chill, the presence of intestinal toxins, quinine, etc. One cannot but admit the respect due to such opinion, but if malaria be a cause, I think there must be some other factor in addition to those named by Prout. I have never seen a case of blackwater fever in India, although I have treated in that country hundreds of cases of malaria in subjects healthy otherwise or debilitated. Moreover Sambon points out that although both may be co-endemic in the same place, yet they each have their peculiar geographical distribution. If malaria be anything more than a predisposing cause of blackwater fever in Africa, it must differ in some intrinsic peculiarity from the malaria of India.

3. *The theory of quinine poisoning* was first held by Professor Tomaselli, who stated that blackwater

fever was a form of poisoning by this drug amongst malarial cachectics. This idea has been revived by Koch, who expressed the dictum that "blackwater "fever was nothing more nor less than quinine "poisoning." Again, Stephens and Christopher, in their "Practical Study of Malaria," maintain that while cases of blackwater fever do occur rarely in persons who have not been treated by quinine, yet that the latter drug is the common cause of the attack. They hold that it is not the quinine itself, but the blood condition of the patient which is the determining factor whether or not the quinine will bring on an attack. "Blackwater fever is then a "quinine intoxication, but it is something more. It "occurs only in those who have previously suffered "from malaria, and, in fact, there is considerable "evidence to show that it occurs frequently in direct "connection with a malarial infection." This may be so, but with regard to either malaria or quinine being causative agents, all my experience, derived as I have said from hundreds of cases of malaria treated by quinine, leads me to the conclusion that neither of these factors has the smallest causative direct agency in India. Moreover, the disease was not described in India until 1885; we cannot surely think that great clinical authorities like Maclean, Chevers, Vandyke Carter—representing the three Presidencies of India—and others would have missed seeing it if it had occurred; it must follow that at that date it was a new disease in that country; yet before this date both malaria and its treatment by quinine were present in all their different aspects.

4. *The theory of chill* has, of course, been put forward for this disease, as for so many others, on account of the rigors ushering in an attack. But it has no more to do with chill than infectious pneumonia, relapsing fever, or pyæmia; like these diseases the rigor is connected with the special parasite.

5. Manson, in 1893, stated that in his opinion the disease was an illness *sui generis*. Sambon likewise holds it to be a distinct morbid entity, caused by a specific parasite, identical or closely allied to the *pyrosoma bigeminum* of Texan cattle fever. Blanchard also supports the view, which has certainly most arguments in its favour. Nevertheless the actual exciting cause is not yet definitely known, although this last theory seems the most likely one.

Symptoms.

An excellent account of the symptoms has been given by Dr. Prout, who has had an extensive experience of the disease in Africa. As his experience greatly exceeds my own, I have drawn chiefly on his portrayal of the disease. In his experience, a previous history of malaria has almost invariably been obtained, on account of which the individual becomes markedly anæmic and cachectic. Then a sudden rigor occurs, the temperature rises, and an hour or two after he will pass "the blackwater." Or the same symptoms may supervene during the course of an ordinary attack of malaria. There are two types—namely:—

A. *The Severe.*—Here the skin is markedly jaundiced, or of a bright lemon colour, with a malodorous perspiration. There is constant vomiting of bile or bile-stained fluid. Distressing retching may be caused by the slightest attempt to drink anything. Constipation is frequent. There is much depression and restlessness. The urine is black like porter, and in the worst cases syrupy in consistence. During this stage of "blackwater" Prout points out that there is a very large *increase* in the quantity passed, which diminishes as the urine clears. Should the case have a fatal termination, in from 24 to 36 hours the urine begins to clear, but diminishes in quantity until there is complete suppression. The vomiting remains persistent and

intractable, finally resembling the "black vomit" of yellow fever. The temperature, which had previously fallen, begins to rise, and the patient dies comatose about the third or fourth day. In cases not terminating in death, the symptoms above detailed gradually cease, and the patient very slowly passes into recovery.

B. *The Mild.*—Here there is very little nausea, the jaundice is but slight, and the high-coloured urine passed in large quantity clears in a few hours. If the urine in blackwater fever be moved from side to side in the vessel, it will leave a reddish thin film as it moves, with brown pigment in the deposit, and, of course, on testing it, albumen will be found. These characteristics distinguish it from bile in the urine.

TREATMENT.

This is again one of the diseases in which a well-trained nurse can do much for the benefit of her patient. The medical treatment will be in the hands of the medical attendant and so is not mentioned here. The nurse must, in the first place, keep a cheerful countenance, as the patient may naturally be somewhat nervous at the sudden appearance of the "blackwater." Such little things as keeping the samples of urine out of the sight of the sick individual must not be forgotten; he must be kept warm in bed. Sponging the body with eau de Cologne in warm water, and frequently bathing the hands also with water is very grateful to the patient. Should the physician decide to inject salt solution into the subcutaneous connective tissue, she will have to prepare this; the strength of the solution is a teaspoonful to the pint of water. Another most important precaution to take is never to allow the patient to sit up or get out of bed until permitted to do so by the physician, for death by syncope might otherwise ensue. Dr. Prout's words

are as follows: "Recovery chiefly depends on "careful nursing." The mortality may be put down at on an average 25 per cent. Prout mentions 24 cases treated in a nursing home—out of these eight died, or 33 per cent.

With regard to the feeding of the patient there may be great difficulty. If the patient vomits everything the nurse should not attempt to force him continually to take food, the best thing to do is to tide over this period of vomiting by supporting the patient with nutrient enemata. If he can retain food, then this must be of the simplest description, and in a fluid form.

Preventive Treatment.—Quinine should be taken *regularly*, not intermittently, in regions in which blackwater fever is rife. Prout gives it in 5 grain doses daily. He instances a case that had suffered five times from the disease, but, after taking his regular dose of quinine, had so far, up to seventeen months, not experienced it again.

Should a patient who has had one attack and been invalided home, return to the district of blackwater fever?—Opinions would appear to differ on this point. Prout states that provided he has first had a long recuperative residence in a temperate climate, and is able to take quinine without ill-effect, he sees no reason why he should not return. Old residents in Africa have, according to Manson, passed through ten or more attacks with impunity. But there has been a certain amount of good fortune in such cases; it does not follow because the first attack is of a mild character that the subsequent one will be so likewise, and therefore other authorities recommend anyone who has one attack and successfully got over it to leave the endemic region, or, if invalided home, not to return to it. Such would be my own advice to a patient.

THE END.

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